JUNE 1, 1953

Electrical World

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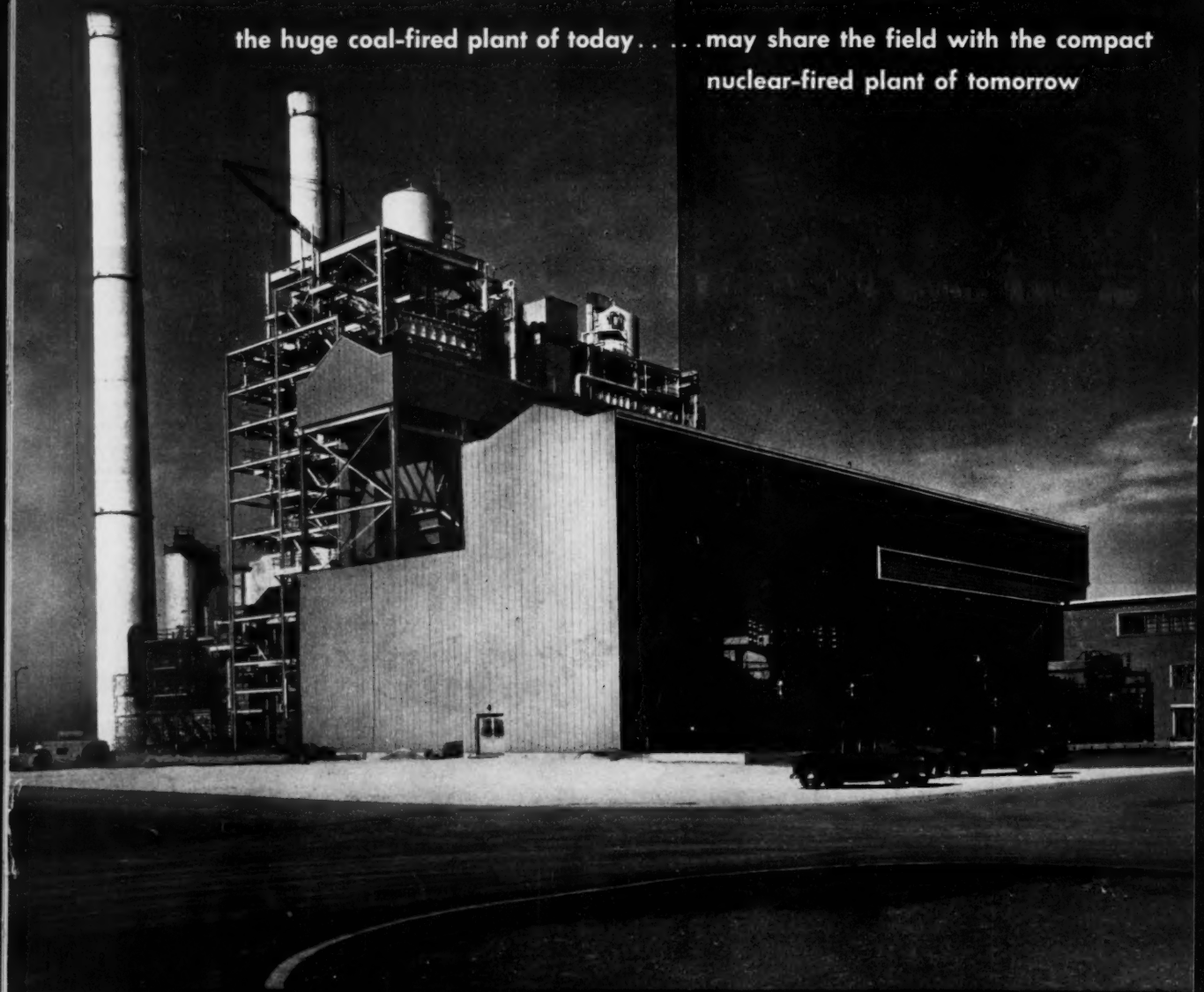
When utilities enter the atomic age . . .

the huge coal-fired plant of today. . . . .may share the field with the compact nuclear-fired plant of tomorrow



Commonwealth Edison–Public Service team answers . . . .

IS ATOMIC POWER GENERATION FEASIBLE?

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Quality Equipment — serving the electrical industry for over half a century.

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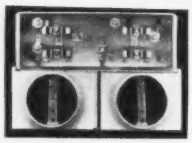
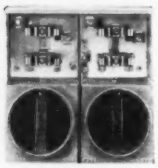
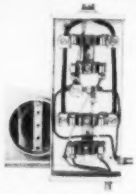


SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS



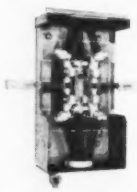
Raintight type — horizontal.



Raintight type — vertical.

SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.



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Up to 200 Amperes.

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For "A" Base Meter Boxes.
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"A" BASE METER CONNECTION BOX
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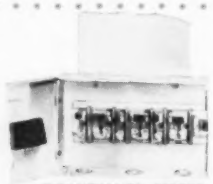
Two sizes up to 2/0 wire.

"A" BASE METER MOUNTING AND TEST CABINET
Indoor. Single phase and polyphase up to 200 Amps.



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C.T. current transformer cabinets available.

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AERIAL LADDERS

New pedestal mount occupies least truck floor space. Fastest, easiest and safest operation. Made in three working heights — 29', 32'9 and 36'8.

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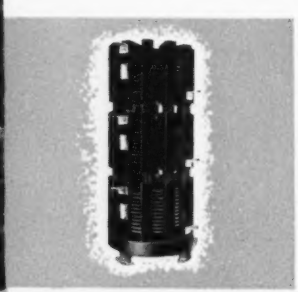
Light and heavy duty.
Porcelain insulators.



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Dry type. Glass insulation.

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Service Entrance and Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D). Current Limiting Reactors • Crows'nest Aerial Ladders • Utility Specialties

The Atomic Scientist

The country's most mysterious men are the atomic scientists. The government keeps them hidden. But the sketch shows what one looks like—bushy hair; heavy, tortoise-rim glasses; mustache; and a van dyke.

Working with such scientists as these, four utility-industrial teams have been determining the prospects for private industrial participation in joint production of electric energy and fissionable material from reactors. More than 100 engineers and scientists of the eight firms were cleared for access to restricted data. The first of a series on their findings, or as much as can be revealed about them, begins in this issue.

No Bearded One

Robert W. Gillette as senior engineer of the Electrical Engineering Department of Consolidated Edison of New York rates only a mustache instead of a beard (See photo). There is no mantle of secrecy about his work. In this issue he relates his experience with pipe-type cable.

Bob lives in Flushing,, N. Y., where he raises rhododendrons. He gets other amusement from playing a pipe-organ—probably more from the electro-pneumatic control equipment than from the music. On his vacation trips he takes color photographs.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Installing 15kv-rated Okolite-Okoprene Self-Supporting Cable in a suburban community

at 5 kv or 15 kv—

YOU CAN REDUCE TREE TRIMMING, ELIMINATE HIGH POLES

Whether or not to raise distribution from 5kv to 15kv level is a problem being posed by ever-increasing residential growth. If the cost of tree-trimming or overbuilding with high poles is your principal obstacle, consider the proved advantages of Okolite-Okoprene Self-Supporting Cable.

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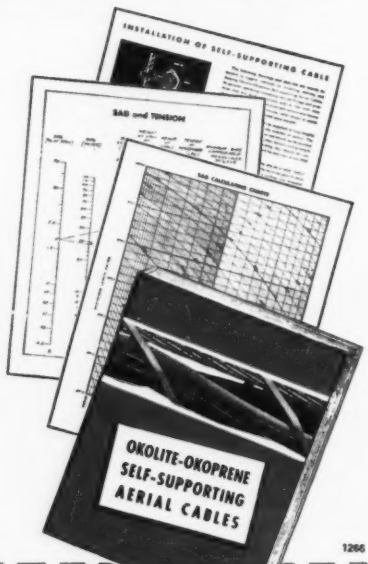

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OKONITE SINCE 1878

insulated wires and cables

The Okonite Company
Passaic, N. J.

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HOT-LINE TOOLS

and SAFETY ACCESSORIES

...via GraybaR

Your linemen are only as safe as their equipment—lives depend on its quality.

So, for sure, certain all-over protection order hot-line and safety needs from your near-by Graybar office. Made by well-known, highly-regarded manufacturers, they're all products your linemen respect . . . work with in confidence.

Chance hot-line tools — Graybar can supply Chance hot-line maintenance tools individually or in sets. Incorporating the latest developments in equipment for handling energized lines, Chance tools are tested to withstand 75,000 volts per foot. Metal fittings are lightweight, heat-treated aluminum alloy...poles are laminated Sitka Spruce. There's a specialized Chance tool designed to do every hot-line job safely and efficiently.

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Call Graybar for all of your other pole-line needs as well. You can rely on your local Graybar Representative to provide complete, accurate information on anything you require. For special help on out-of-the ordinary problems, feel free to ask for the assistance of a Graybar Outside Construction Specialist. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

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Straight-Forward Circuits to bring your message in without interference—even when you're operating close to an adjacent-channel transmitter.

Automatic Modulation Control to lower loud voices, raise weak voices, to correct level, without distortion.

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Full Frequency Range: Fleetfone 30-50 mc, Carfone 152-174 mc.

Fits Anywhere: Transmitter-receiver unit takes no more space than a spare tire, mounts in any position, operates at low drain on 6- or 12-volt battery.

Stable Performance for minimum distortion. Ovenless crystals stay on frequency without warm-up, without wasting stand-by power.

Single-Case Construction for easy tuning and servicing. Offers plenty of protection—makes chassis and all components instantly accessible.

For Extra Dependability, installation and service facilities of the RCA Service Company are available.

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Part of the welding floor at Grinnell's Warren, Ohio Plant

How shop fabrication of piping

keeps costs down...quality up!

When you specify piping fabricated in Grinnell shops, you are ALL to the good.

Here's why: — Included in the price (which is determined in advance) are such items of expense as:

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- Shop sketches and planning
- Procurement of materials
- Heat, light, power, water, compressed air, expendable tools and supplies

But Grinnell even goes further. Grinnell finances material inventories and payrolls for you; carries insurance; makes no charges for waste material or spoilage.

On the production side, too, you benefit. Piping fabricated in Grinnell shops is done under ideal conditions, with modern equipment, by personnel qualified for each class of work. It is rigidly inspected and tested to meet customer's specifications and all applicable codes. Before shipment, it is cleaned inside and outside and painted. It is squared to dimensional tolerances, so that sub-assemblies can be erected at the job site quickly and easily.

You can count on it . . . Grinnell shop fabricated piping *guarantees* maximum quality and economy.

Heavy wall pipe being machined to the proper welding bevel on a post mill

Welding (induction heating coils in place for preheat, welding heat and stress relieving.)

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Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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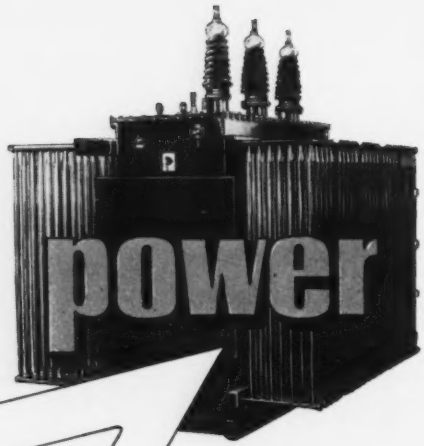
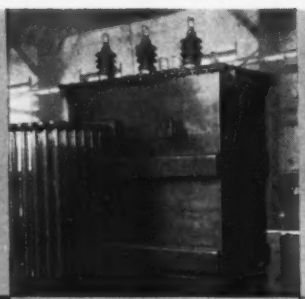
Uptegraff power Transformers



Long Life and Low Maintenance assured by important features of ***Design and Construction***

RUGGED

Special tank bracing withstands pressures of ±10 psi for ratings of 44 KV and less, and ±15 psi for higher ratings. Radiators are sturdy, yet accessible for cleaning and painting.

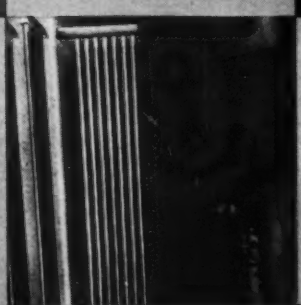


TIGHT

To eliminate leaks in sealed joints, a modern supersensitive electronic leak detector is used. It will find leaks as small as one ounce of air per year!

UNDERCOATED

The under surfaces of all Uptegraff Power Transformers are treated with a heavy coating that protects inaccessible areas against corrosion.

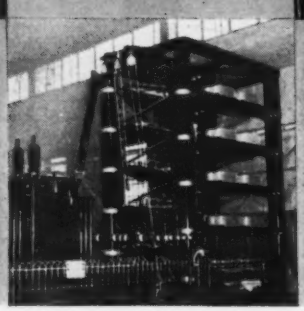


SHOT BLASTED

Tanks are thoroughly cleaned by shot blasting to prepare surface before protective paint coats are applied.

TESTED

Every Uptegraff Power Transformer is thoroughly tested before shipment. Modern test equipment includes a 1.5-million volt surge generator. We are fully qualified and equipped to make all NEMA, AIEE, ASA and other tests up to 10,000 KVA.



ALL SIZES

Made in sizes to 10,000 KVA, 115 KV for indoor or outdoor service. Oil or askarel filled. Uptegraff transformers meet the standards of ASA, NEMA and AIEE, and are *fully guaranteed.*

R. E. Uptegraff Manufacturing Co.

Scottdale, Pa.

CADWELD®

is the BEST ELECTRICAL CONNECTION

Not only on the surface

For the best in grounding connections—there is only one answer—CADWELD. Regardless of whether the cables are exposed or buried in the earth or concrete, CADWELD gives you the best electrical grounding connection possible.

The solid copper CADWELD CONNECTION has 3 big advantages:

1. **It is permanent**
2. **It cannot loosen or corrode**
3. **It has a current carrying capacity greater than the cable**

In addition CADWELD is ideal for all construction work as it requires no outside source of power and the equipment is lightweight and portable.

500 MCM short circuiting conductors CADWELDED around the reinforcing bars of a large concrete beam. Under the beam will run the generator leads. These cables remove the induced currents in the reinforcing bars that would otherwise produce heat and destroy the concrete.

FOR ELECTRIFYING RESULTS

CADWELD®

Electrical Catalog on request.

CADWELDED straight splice of 500 MCM cable

ERICO PRODUCTS, Inc.

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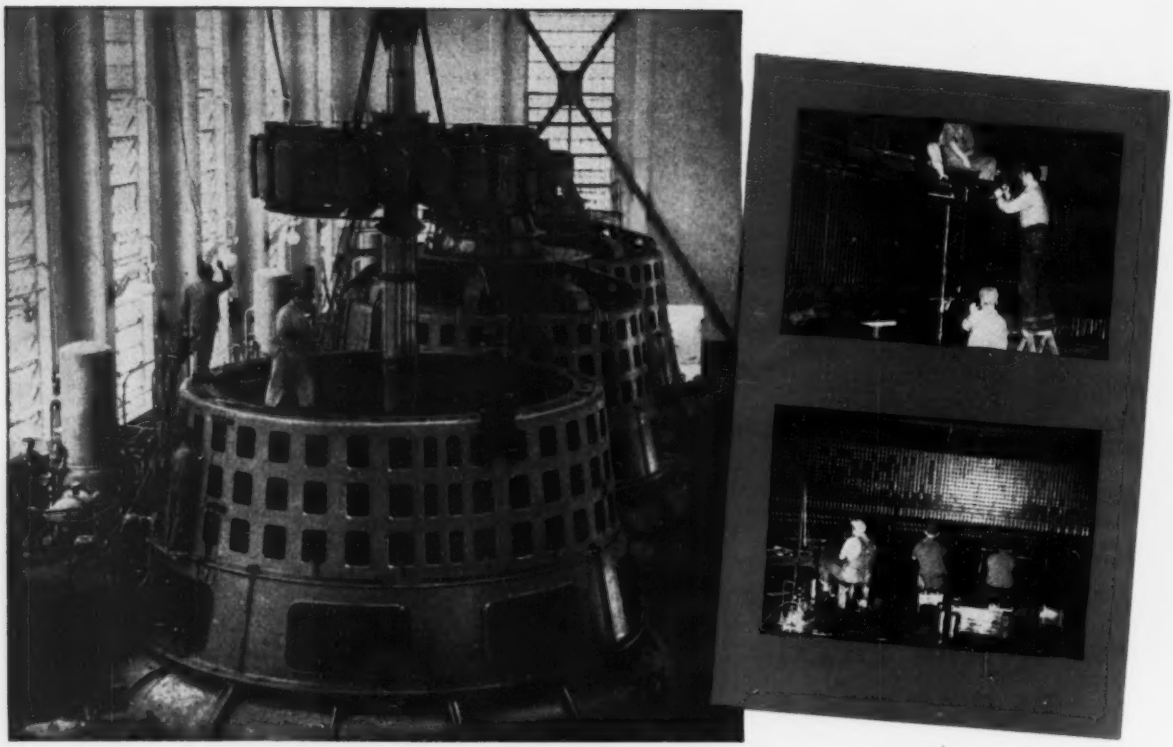
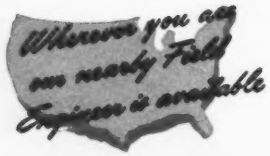
CLEVELAND 3, OHIO



generator windings with a *Longer* life span

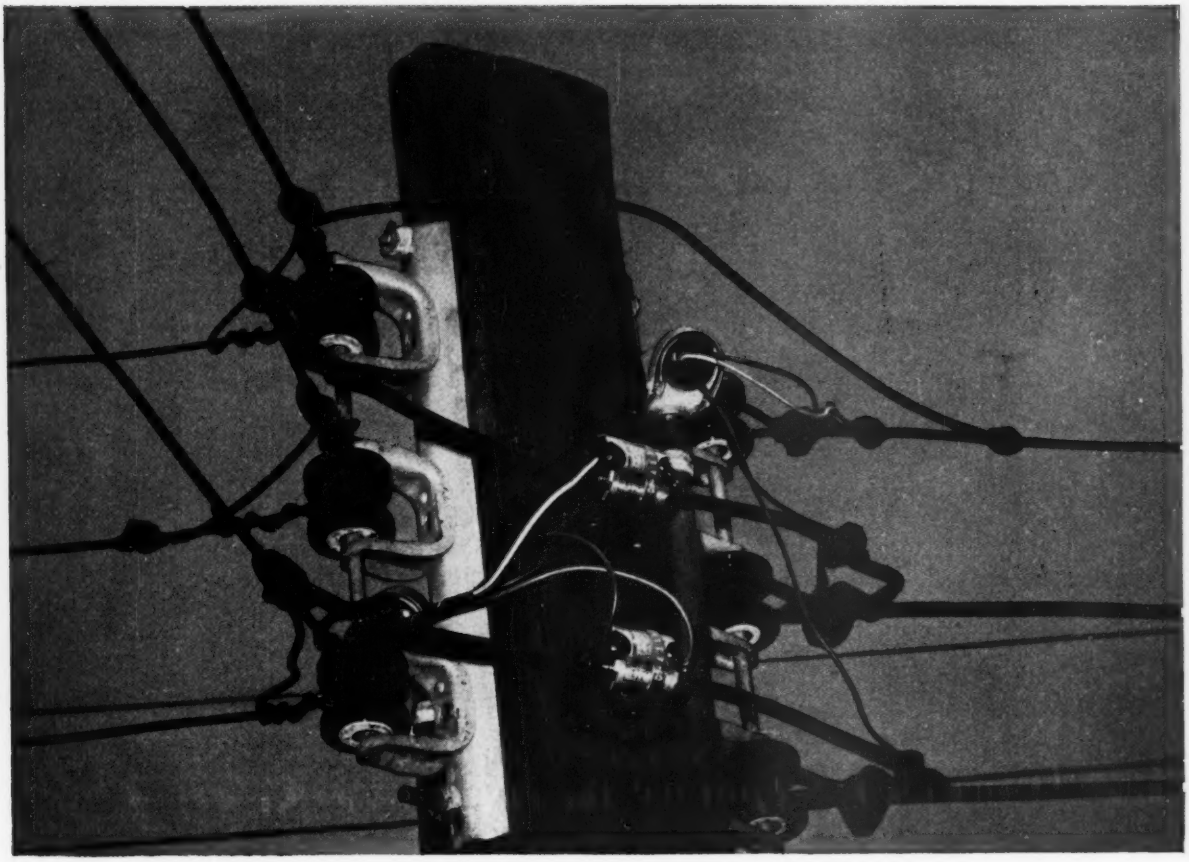
Throughout the country, large generators are turning out more power as a result of National redesign work, National replacement windings and National rebuilding. In many cases, electrical characteristics have been changed to meet changed needs. In others, power output has been increased to meet increased demands. In still others, recurring trouble has been eliminated. In all cases, long life is assured. From the simplest replacement coil to the most complicated redesign job, National Electric Coil is dedicated not only to maintenance but also to *improvement*. When *any* piece of rotating electrical equipment presents a problem, communicate with National.



NATIONAL ELECTRIC COIL COMPANY

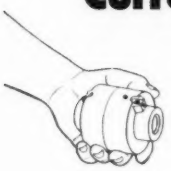
COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES



CUT INSTALLATION COSTS

with the *new* SANGAMO Type R Current Transformers



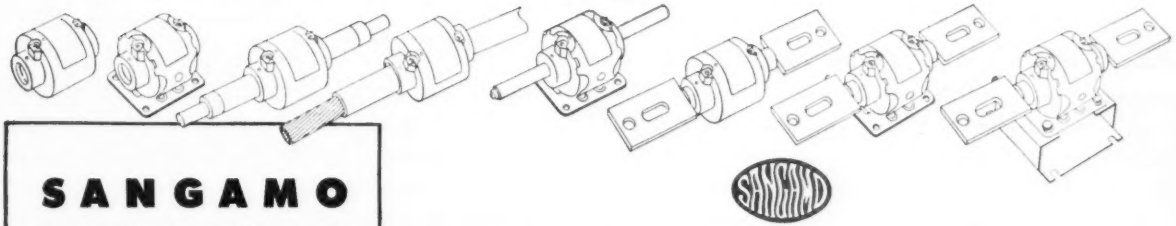
Eight variations of ONE basic transformer permit almost any primary arrangement.

New time and money saving installation methods are now made possible by the small size and light weight of Sangamo Type R Current Transformers.

In the installation shown above, made by a southern utility company, the base of the transformer is mounted to the pole. However, this rugged transformer is light enough so that it can also be mounted without the base by merely supporting it by the cable. Another saving is enabled by wiring secondary leads in the shop, with subsequent reduction in field installation time.

Type R Transformers are encased in a high impact phenolic shell filled with a thermo-setting plastic that eliminates voids and prevents moisture from reaching the core windings. The large opening in the Type RC-6 Transformer will admit a 250 MCM weatherproof cable in the 200 ampere rating, and 500 MCM weatherproof in the 400 ampere.

Full information is given in Bulletin 501. Be sure to get your copy.

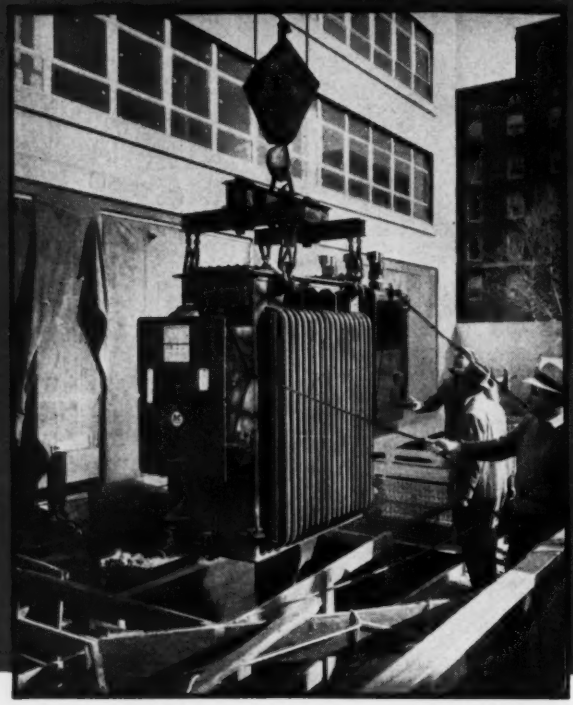


SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Only Measured Facts are Known Facts

SM53-5

1 **New Network Transformer Installation** provides principal power supply for new office building. Pictures show transformer being moved to site and being installed.



2 **This 750-kva Network Transformer** will supply all electrical service except for air conditioning motors. Location is at junction of Connecticut Avenue and "K" Street, 4 blocks from White House.

A Network Transformer Goes to Washington!

ALLIS-CHALMERS TRANSFORMERS USED ON POTOMAC ELECTRIC'S SYSTEM

Allis-Chalmers is proud to help serve on the fine network system of the Potomac Electric Power Company. Having had 15 years' experience with Allis-Chalmers network transformers, this utility has found them to give highly efficient performance.

Excellence in construction detail is a major reason why Allis-Chalmers network transformers are chosen by so many utilities. Over 1¼ million kva of these units are now serving the nation's most important systems. Compact, low-loss design and high thermal capacity of Allis-Chalmers network transformers meet the severest load conditions.

See your nearest A-C district office for more details or write Allis-Chalmers, Milwaukee 1, Wisconsin.

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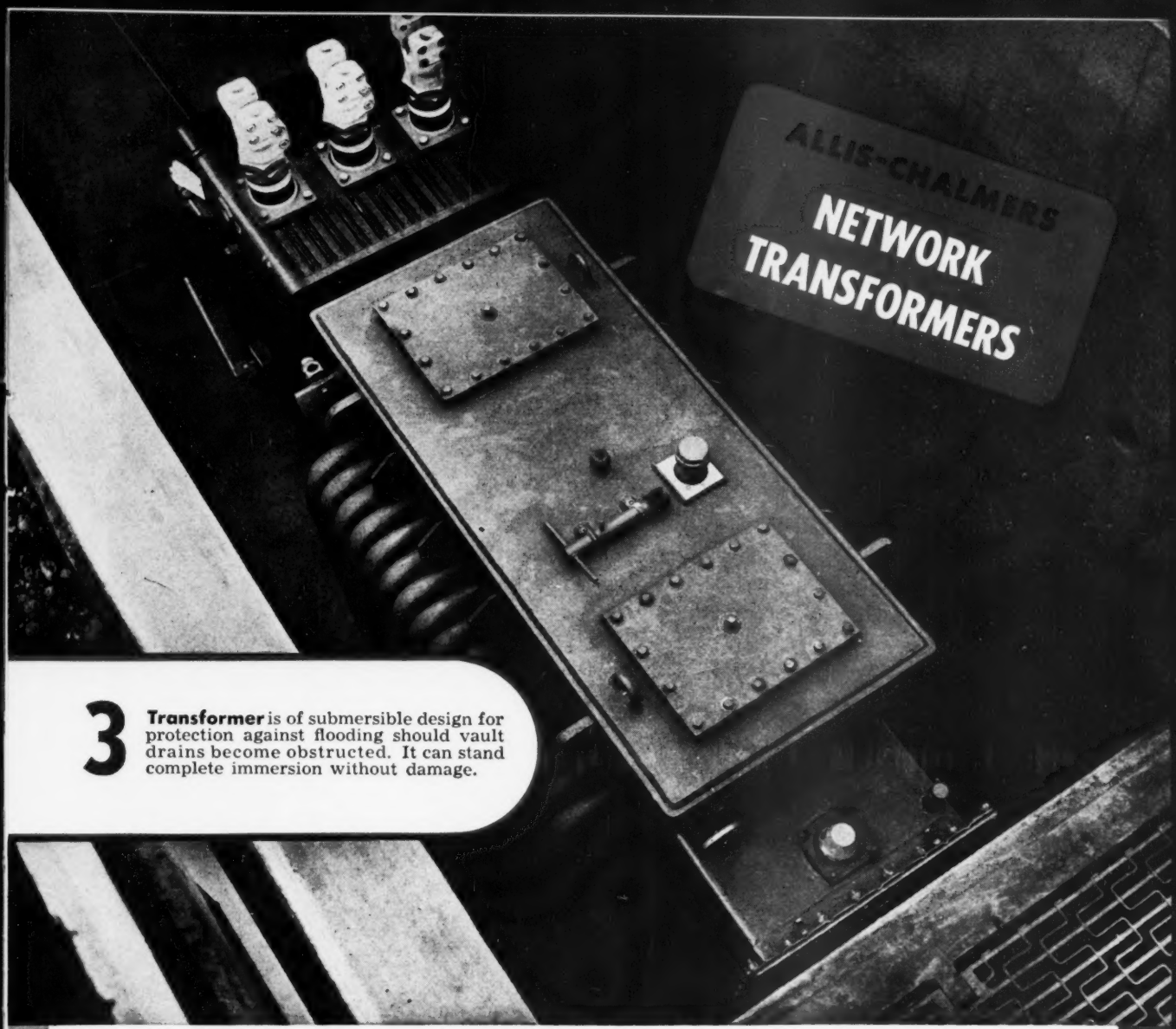
ALLIS-CHALMERS



3 **Transformer** is of submersible design for protection against flooding should vault drains become obstructed. It can stand complete immersion without damage.

Here are Reasons Why the System Will Benefit

Spiral Wound Gaskets Are Performance Proved

In over 5 years of continuous use, spiral wound gaskets have proved their superiority over other types of gasket material for sealing bushings in the tank wall.

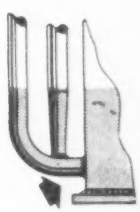
Alternate plies of preformed spring-like metal and non-metallic fillers provide unusual resilience that actually adjusts itself to changes in operating conditions. This gasket, installed without the use of cements or grease, simplifies the removal of bushings if required. The gasket may be re-used if necessary.

Weld-Seal Construction Eliminates Major Gaskets

The main cover and switch compartment are welded to the tank to eliminate leaks. Oil sludging and oxidation of insulation is minimized.

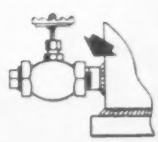
Special Surface Treatment Provided

Areas that may be exposed to severe corrosive conditions are thoroughly protected. Tank surfaces are grit-cleaned and given three coats of baked-on phenolic paint (formulated for moisture resistance). A special bituminous compound gives added protection to surfaces and tubes in base areas.



Threaded Valve Connections Are Solder-Wiped

Threaded valve connections are solder-wiped for extra protection. Valves are located for maximum accessibility. Globe type valves with non-rotating seats close tight, avoiding wear on valve seats.



YOU HAVE TO GO INSIDE

Almost all cables look alike on the outside. You have to go inside the jacket to the insulation if you want to see how good the cable really is. In power cables it's the insulation that makes the difference. This fact may be borne out in years of service or as a result of rigorous laboratory tests.

ANHYDREX SA insulation is guaranteed not to absorb more than 20 milligrams of water when soaked at 158°F. (70°C.). Its dielectric constant will not exceed 3.2 after one day's immersion in water at 158°F. (70°C.). Between one day and eight days' immersion in water at 158°F. (70°C.), the increase of capacitance will not exceed 3.5% for insulation thicknesses greater than 4/64" or 5% for insulation thicknesses of 4/64" or less. At the end of eight days in water at 158°F. (70°C.) the power factor will not exceed 1%.

No ANHYDREX cable has ever failed due to water absorption. There is no better proof that the electrical properties of ANHYDREX SA insulation remain remarkably stable in the presence of water for a long period of time. Specify ANHYDREX SA insulated cables for underground, duct, or aerial installations at voltages up to 2000 V.W.P. For more complete information, contact your nearest Simplex representative or write to the address below.

SIMPLEX ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

MACHINE MILESTONES... MEASURED IN OIL! The impressive record of petroleum "firsts" listed above spans 87 years of industry's most spectacular progress. From the first mineral oils for machines in 1866 to the first oils for Diesel engines, cars, planes—right on up to correct lubrication for the world's fastest superliner—Socony-Vacuum has pioneered the development of the products that have helped make these advances possible. Today, this wealth of lubrication knowledge and experience is yours—to help boost your output, cut your maintenance costs. Why accept anything less?

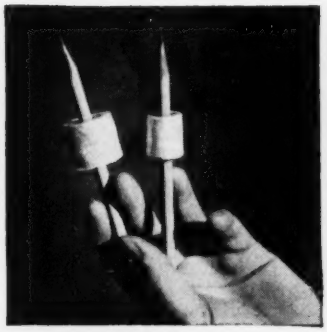
SOCONY-VACUUM
Correct Lubrication

SOCONY-VACUUM

SOCONY-VACUUM OIL COMPANY, INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

New!
An economical woven glass tape for Class A coils!
Better performance
No premium cost
Made with Fiberglas yarns

AT A COST NO HIGHER THAN THAT OF COTTON, THIS IMPORTANT NEW GLASS TAPE BRINGS YOU ALL THE PLUS FEATURES OF GLASS ITSELF!



it's thinner . . .
only 4 mils thick, yet designed to replace 7-mil cotton tapes.

it's stronger . . .
with tensile strength of 125 lbs. per inch width, easily twice that of cotton.

it's longer-lasting . . .
because glass won't rot and resists moisture, oils and most acids.

it's overload insurance . . .
because glass won't burn, withstands higher temperatures.

it's easy to use . . .
specially treated for quick, easy hand or machine use.

If you haven't already checked into the possibilities of this tape, be sure to call your supplier today — or write direct to Owens-Corning Fiberglas Corp., Dept. 858, 16 East 56th Street, New York 22, N. Y.

* Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

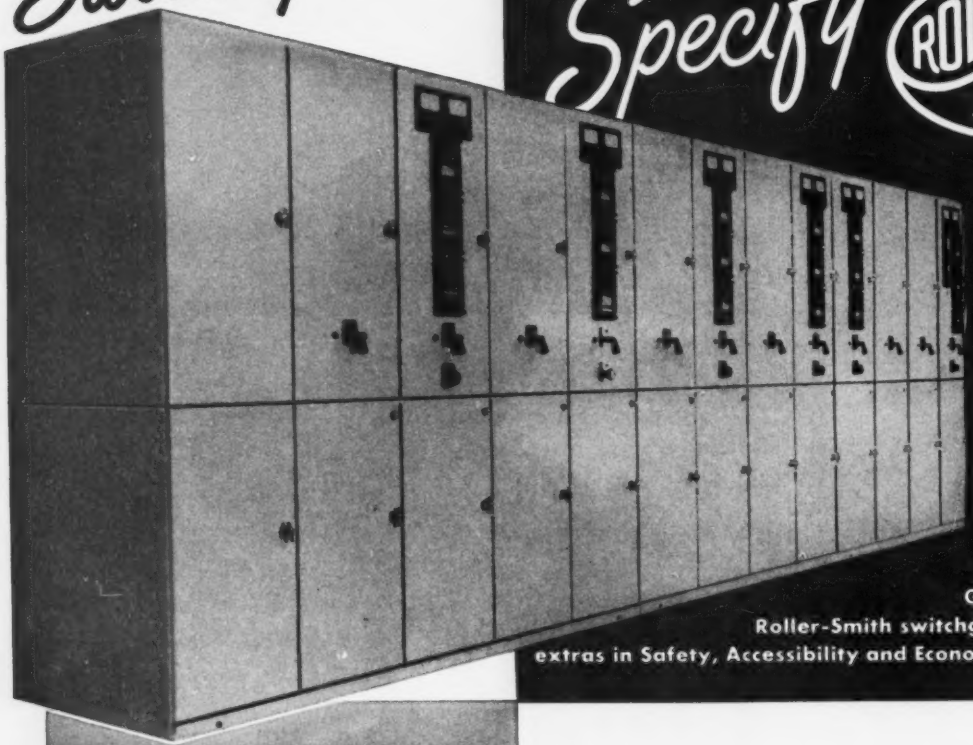
OWENS-CORNING
FIBERGLAS
TM REG. U.S. PAT. OFF.

"if it's Fiberglas, it's Owens-Corning!"

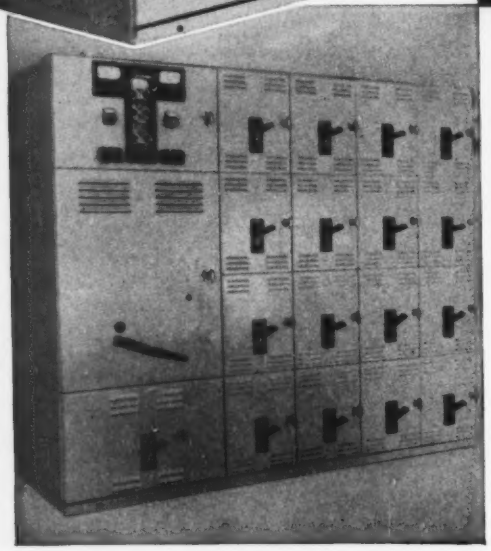
in Switchgear...

EXTRAS COUNT!

Specify ROLLER SMITH



Get all the extras
Roller-Smith switchgear provides . . .
extras in Safety, Accessibility and Economy of operation.



● **SAFE** All equipment is metal enclosed . . . weather proofed when required . . . built to NEMA and AIEE standards for safe, dependable performance. The "up-to-the-minute" design of Roller-Smith switchgear assures *extra* safety for operators.

● **ACCESSIBLE** All sections of RS switchgear are easily accessible for quick inspection and adjustment. This cuts maintenance time to a minimum . . . makes it easier to do a thorough job.

● **ECONOMICAL** All Roller-Smith equipment is precision-built according to your specifications . . . tested *before* you get it. When you specify Roller-Smith, you can count on *extra* long, trouble-free operation with less "down time" for repairs.

Consult your nearest Roller-Smith representative, or write to us for catalogs which fully illustrate and describe our complete line of low voltage draw-out; moderate duty, vertical lift Metal Clad; and heavy duty Metal Clad switchgear.

ROLLER-SMITH CORPORATION
Bethlehem, Pennsylvania

ROLLER SMITH

ANACONDA FORUM
for the Electrical Industry

REVISED ELECTRIC POWER EXPANSION PROGRAM

By: Walker L. Cisler, Chairman,
Electric Power Survey Committee,
Edison Electric Institute

FOLLOWING the outbreak of fighting in Korea in June 1950, the electric power systems of the United States promptly anticipated greatly increased power demands and revised the planned electric power expansion program sharply upwards. Between June of 1950 and April 1951, new generating projects totaling 20 million kilowatts were undertaken and orders for the equipment were placed with the manufacturers. As shown in the table, by April 1951 new projects totaling 32.1 million kilowatts were scheduled for operation, mostly before the end of 1954.

NEW POWER GOALS FOR 1956

Now, nearly two years later, the electric power expansion program has been enlarged further to total 47.7 million kilowatts planned for commercial operation in the years 1951 through 1956 and the programs for 1955 and 1956 are still incomplete. Thus within less than two years it has been necessary to plan and begin construction of projects having a generating capacity of 15.6 million kilowatts to keep pace with the electric power demands now forecast for 1954, 1955 and 1956. Approximately 4 million kilowatts of this is specifically for new requirements of the Atomic Energy Commission.

SHORTAGES HAMPER FULFILMENT

The progress which was made in 1951 and 1952 in fulfilling this program has been disappointing. In April 1951 about 16.0 million kilowatts of capacity was scheduled for operation in the two years, 1951 and 1952. Largely because of delays in obtaining materials for equipment manufacture and field construction, only 13.5 million kilowatts were completed in those two years.

The 2.5 million kilowatts which were not completed in 1952 have now been rescheduled into 1953, some projects, originally scheduled for 1953, have been rescheduled into 1954 and other projects, originally scheduled for 1954, have been rescheduled into 1955.

NEW PROGRAM CALLS FOR GREATER EFFORT

As a result of these changes, and the additions to the total program, 12.2 million kilowatts of new capacity are now scheduled for completion in 1953 and 10.6 million kilowatts in 1954. This is a truly stupendous program and because of the material shortages which have occurred during 1951 and 1952, there are grave doubts whether these goals can be met.

Great effort will be needed by all concerned to carry the program forward as closely as possible to schedule. Power requirements for 1953 and 1954 can be estimated with reasonable accuracy and capacity now planned is essential to provide satisfactory margins.

As we progress through the years, new requirements will develop, additional projects will be planned and efforts to complete them must continue unabated.

ELECTRIC POWER EXPANSION PROGRAM

Capacities Given as Millions of Kilowatts—Manufacturers Nameplate Rating

Scheduled for Operation	As of April 1, 1951	As of April 1, 1952	As of January 1953
1951	7.5	6.9*	6.9*
1952	8.5	8.9	6.6**
1953	10.7	11.9	12.2
1954	4.8	10.3	10.6
1955	0.6	4.0	9.2
1956	—	—	2.2
Total	**32.1**	**42.0**	**47.7**
New Capacity Planned Since April 1, 1951		9.9	15.6

*Actually completed during 1951.
**Actually completed during 1952.

SERVICE NEEDED FOR 3,750,000 UNITS BY 1956

New ANACONDA Type N-SD Service Drop Cable can help speed installation . . . available in copper or aluminum

That's the mark the nation's builders will shoot for in the next 3 years (according to F. W. Dodge Co.). Power companies must match their efforts by providing prompt and adequate electric service.

Important consideration will be given to speed, ease and appearance of installation. These requirements are met by ANACONDA Type N-SD Cable—available with either neoprene or polyethylene insulation.

This cable handles easily . . . looks neat . . . is durable . . . resists weather. Two insulated conductors are wrapped around—and fully supported by—a bare neutral messenger. Conductors remain free of tension!

RIGHT TO THE RANGE. Where Type N-SD Cable is used to the weatherhead, contractors will find SILVALINE*, ANACONDA's URC Type SE Service Entrance Cable economical to install through meter and fuse box right to such appliances as ranges, water heaters. SILVALINE has special silvery finish that won't "blotch" when painted.

*Trademark

ANACONDA FORUM

BUILDING OR EXPANDING YOUR ELECTRICAL PLANT?

In either planning a new electrical plant or correcting and improving an inadequate plant, it may save many a future headache to consider carefully these cable-selection pointers:

- An ample-size conductor always works for you.
- Choose your cable covering for its environment.
- Improve voltage regulation by using a larger conductor, reducing conductor spacing, dividing (or paralleling) circuits, improving power factor, and keeping high fluctuating load on separate feeders.
- Avoid loading feeders above 400 amperes, except in unusual cases. Above 400, cable becomes bulky, conduit expensive, difficult to install, and amount of load dropped on a fault is considerable.
- Conductor size should meet requirements for voltage regulation and current-carrying capacity for normal load and for motor circuits, short-circuit amperes.
- For greater reliability in insulated conductors, select Type RH, RH-RW, TW or Butyl-insulated instead of Types R or T.
- Aluminum conductors are satisfactory when properly installed.

"Bottlenecks" have no more place in power distribution than in shipping, accounting or administration departments. Best cure for electrical inadequacy is to install a well-designed, thoroughly engineered electrical system at the start . . . with cable that is right for the job.

BIG BOOM IN THE VALLEY. U.S. Steel builds its new Fairless Works in rural Bucks County, Penna. To meet the expanding needs for power—in new plants and homes—utilities in the area are adding new generating capacity and rushing new transmission and installation lines in the Delaware Valley.

ANACONDA FORUM

INDUSTRIAL LIGHTING . . .

It's important to match cables to today's lighting needs

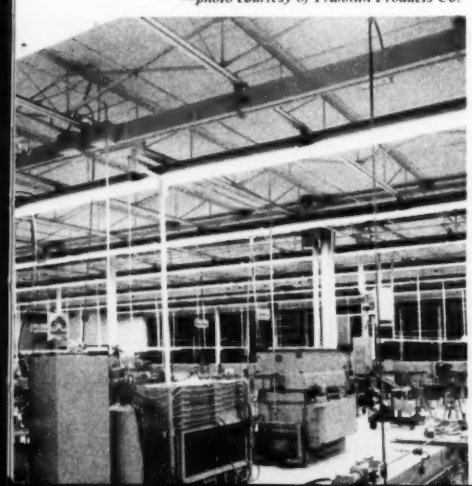
There are many reasons why today's lighting requirements are greater than in the past. There is a very definite relationship between higher intensity of illumination and greater and more efficient (or lower-overall cost) production. The demand for better lighting is continually increasing because people's ideas change with the continuous increase in efficiency of light production. You can readily see that today's industrial lighting, more often than not, requires fair-sized cable for feeders and branch circuits. Transformers located at convenient points make long runs less frequent and less necessary.

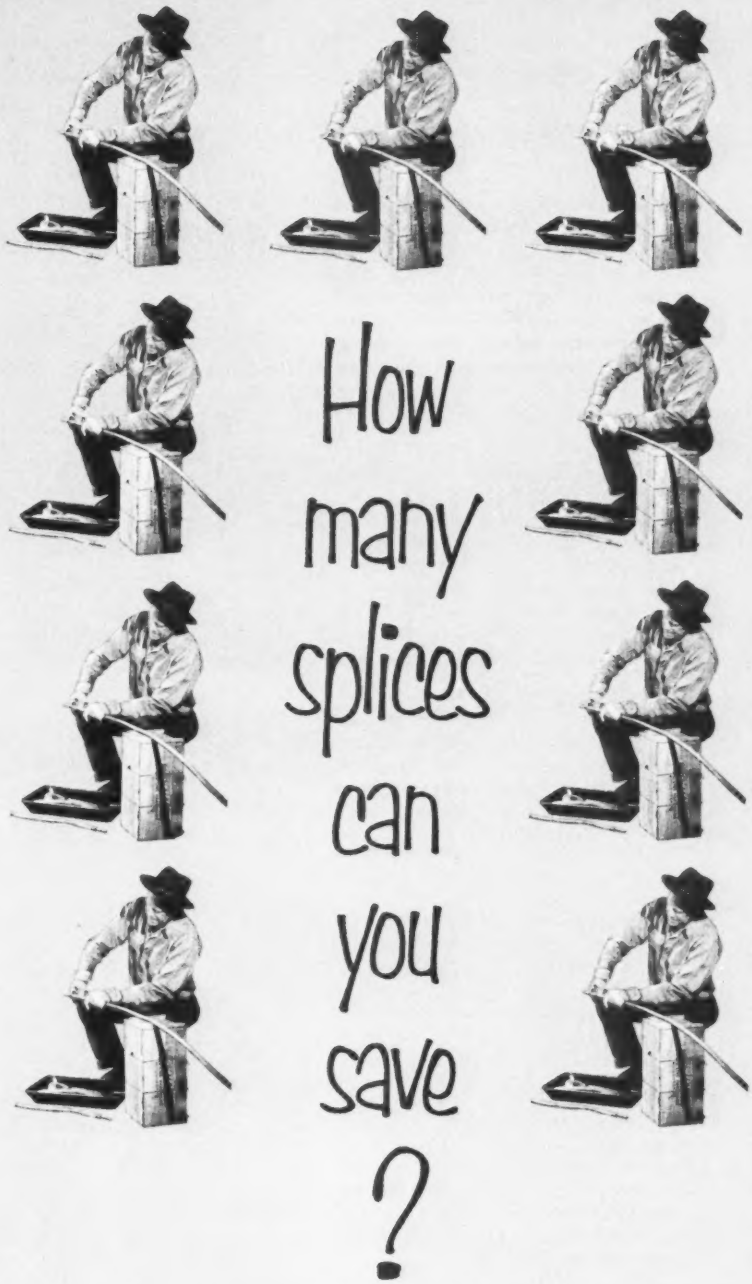
The principal conductors which may be used in industrial lighting are Types R, RH and RH-RW rubber and TW thermoplastic. Cables must be selected to satisfy two requirements: safe ampere load and permissible voltage drop. The smallest size—No. 14 Awg—should be used with care. Allowable current ratings, as given in the National Electric Code, are for safety only and may not satisfy voltage-drop requirements at all. This latter point cannot be stressed too often.

Good lighting is an important production tool. But, regardless of the number of units installed, a lighting system is no better than the circuits that serve it. Good lamp life and illumination efficiency depend upon operation at rated voltage—and this is only obtainable with circuit adequacy. And last but certainly not least, the design of the circuit should be made flexible enough to permit additions or alterations in the future. Some recent jobs have been designed and installed so that feeders and branch circuits are good for twice the present illumination.

THIS WORK AREA, 80 x 140 ft., is lighted by 136 fixtures to provide 50 foot-candles. Each fixture has two 75-watt, 96T-12 standard warm white fluorescent lamps.

—photo courtesy of Franklin Products Co.





All-Purpose DURASHEATH Cable is selected by industrial plants to simplify installations

The order of the day is expansion of power facilities. In industry this expansion means new power lines. Where these lines demand different types of cable as they shift from one location to another, time-consuming jointing becomes necessary. Jointing costs money . . . slows down cable installation.

Industrial plants have found a way out of these difficulties. They select DURASHEATH*, Anaconda's neoprene-jacketed power cable. This time-tested cable may be buried, strung overhead, and run in ducts *in one continuous run.* One cable type—not three—is needed.

DURASHEATH is available in all sizes, single or multi-conductor, copper or aluminum, from 600 to 15,000 volts. Use it for power cable in industrial plants, railroads, series or multiple street lighting, traffic control, and airport† lighting, residential primaries and secondaries, and for Type USE cable for underground service entrance.

*Reg. U.S. Pat. Off.

†*when ordered to CAA Specifications L-824*

SHORTS THAT MAKE SENSE

TAILOR-MADE. Do you know that you can purchase "packaged" power load centers and their components? You will find them easily installed and easily moved. They are well-engineered and basically right for your electrical plant. When you select the right cable to match them, you produce safe operation, prolong cable life and add to your service dependability.

WRONG CABLE. Here's a story with a moral: it pays to choose the right cable. An industrial plant routed a 1-conductor, 500 Mcm rubber and braid (Type R) conductor for a feeder run through 3 buildings, one a boiler house. Result: early failure where it ran through the boiler house. Insulation and braid became brittle, cracked and of no value. Ambient temperature was too high.

SAVE AND IMPROVE. Dry-type transformers have made great strides in their development for lighting. If you locate them at any convenient nearby point, you will save on copper size and at the same time improve voltage regulation.

START RIGHT. Cures cost money; prevention always has a lower price tag. To avoid trouble from electrical inadequacy, install a well-designed, thoroughly engineered system in the beginning. If you inherit an inadequate system, make specific check-ups at once to find the causes; then take proper steps to remedy the situation. Don't wait for real trouble. It never comes at the right time.

SYSTEM PLANNING. It's no joke to be caught with your plant down . . . through failure to anticipate future needs. Look ahead *now* to future needs. Remember that delivery and installation of new equipment take time . . . often up to two years. System planning prepares for potential increase in business.

SINGLE SOURCE. Many cable installations suffer from improper jointing and terminating. Poor design, inadequate materials, wrong methods, or all three are responsible. The cable and its accessories should be considered together. When the combination is furnished by one supplier, the responsibility for correct materials lies with him alone. It also saves time in placing orders.

LIGHTING CIRCUIT POINTERS. Spare lighting capacity is important. Plan carefully for future growth of the lighting system or increased illumination intensities. Consider fixtures to be used. Starting current on some types of units (high intensity mercury vapor) is higher than operating current. Use a minimum of No. 12 wire for all lighting circuits. Keep voltage drop within one percent.

in the years between now and 1956 . . .

which conductor shall it be for America's electric power expansion?

COPPER or ALUMINUM

Some will choose copper . . . some aluminum . . . some both.

Whatever your final choice—it will always pay you to specify ANACONDA . . . because here is a *single* source of supply for:

copper and aluminum insulated cables
copper and aluminum service cables
copper, aluminum and copperweld bare and weatherproof
copper and ACSR transmission and distribution

Here, in the making of conductor, jacket, insulation and the entire cable, modern manufacturing techniques are backed by years of field engineering and construction experience. Metallurgical and development facilities are the most up-to-date.

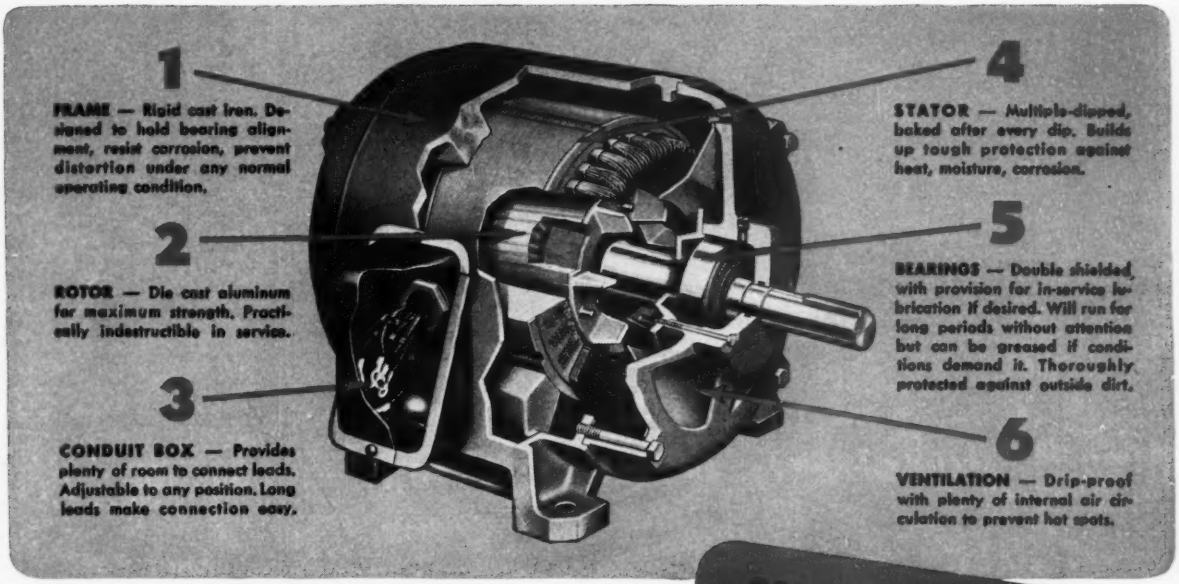
FOR FURTHER INFORMATION about any product mentioned in the pages of this advertisement, see your Anaconda Representative . . . or write to *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

ANACONDA®

TODAY'S HEADQUARTERS FOR WIRE AND CABLE

MAKERS OF building, barn, machine tool, control and communication wire • service and overhead distribution cables, bare and weatherproof including ACSR • portable cords and cables • power and bus-drop cables • mine, bridge, aerial, underground, duct, network and submarine cables • parkway, airport and street-lighting cables station, apparatus and vertical-riser cables • magnet wire • copper, aluminum and copperweld conductors • wire and cable accessories.

Look for These 6 Signs of Good Motor Design


1
FRAME — Rigid cast iron. Designed to hold bearing alignment, resist corrosion, prevent distortion under any normal operating condition.
2
ROTOR — Die cast aluminum for maximum strength. Practically indestructible in service.
3
CONDUIT BOX — Provides plenty of room to connect leads. Adjustable to any position. Long leads make connection easy.
4
STATOR — Multiple-dipped, baked after every dip. Builds up tough protection against heat, moisture, corrosion.
5
BEARINGS — Double shielded with provision for in-service lubrication if desired. Will run for long periods without attention but can be greased if conditions demand it. Thoroughly protected against outside dirt.
6
VENTILATION — Drip-proof with plenty of internal air circulation to prevent hot spots.

Get Allis-Chalmers Motors for these Extra Values!

ALLIS-CHALMERS **MOTORS**

Certified Service — Nearly 100 Allis-Chalmers Certified Service Shops provide factory-approved parts and service on your Allis-Chalmers motors. Screened for modern equipment, adequate experience and business integrity, these independently owned service shops will provide you with prompt, economical repair and maintenance.

Complete Drives from One Source — Allis-Chalmers can supply your complete drive — motor, control and *Texrope* V-belt drive — from one convenient, reliable source.

Application Engineering — Your Allis-Chalmers District Office representative or Authorized Dealer will be glad to help you select exactly the right motors for your needs. For additional information, write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B6052. A-3934

Texrope is an Allis-Chalmers trademark.

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE **V-belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.**

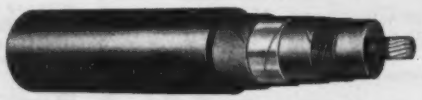
PUMPS — Integral types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

FOR CABLE YOU CAN INSTALL WITH CONFIDENCE

Multi Conductor RoZone-RoPrene® Power Cable—5000 Volts

RoZone-RoPrene Station Control Cable—600 Volts



Single Conductor RoZone-RoPrene Power Cable—8000 Volts Ungrounded Neutral

RoZone-RoPrene Series Street Lighting Cable—2001 to 8000 Volts

SPECIFY RoZone*

The Superior Ozone Resistant Insulation

In high voltage applications where long service life under severe conditions is imperative, Rome RoZone insulation is outstanding. A high quality oil-base compound, its resistance to corona and ozone cutting is exceptional. This, combined with unexcelled resistance to moisture, as well as aging, heat and sunlight, make Rome RoZone insulated cable completely trouble free . . . a cable you can install with complete confidence.

Rome RoZone is the result of years of successful operating experience, modern chemical knowledge, materials and up-to-date facilities. Its remarkable stability in water recommends it as the insulation for cables to be buried direct in earth, in wet locations. High dielectric and impulse strength, excellent aging characteristics, plus immunity to corona and ozone cutting especially qualify Rome RoZone as a superior high voltage insulation.

The dependability and high quality of Rome RoZone have made it *first choice* for many applications.

Unretouched photo of RoZone specimen after long-time ozone test

Unretouched photo of conventional rubber specimen after short-time ozone test

Check These Rome RoZone Premium Quality Features:

- High Dielectric and Impulse Strength
- Excellent Resistance to Corona and Ozone Cutting
- Remarkable Electrical Stability in Water
- Inherent Resistance to Heat, Aging and Sunlight

Rome RoZone is the Ideal Insulation for:

High Voltage Power Cables
Series Street Lighting Cables
Station Control and Signal Cables
General Purpose Wiring Where Dependable Quality is Paramount

It Costs Less To Buy the Best

*T.M. Reg.

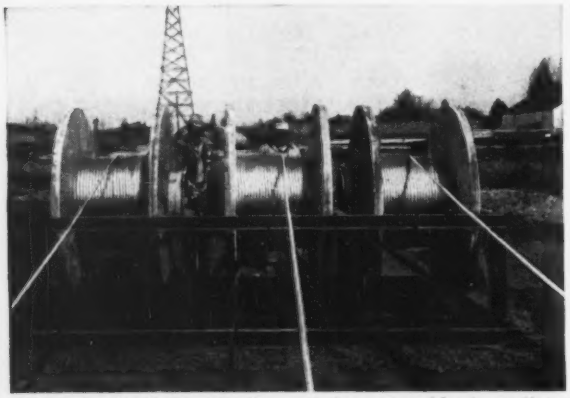
ROME CABLE Corporation
ROME • NEW YORK
and
TORRANCE • CALIFORNIA

You'll get a wealth of helpful information from the Rome Power and Control Cable Catalog. It contains 65 pages of illustrated information, specification and test data on all Rome power and control cables and on famous Rome insulations. Mail the coupon for your copy today.

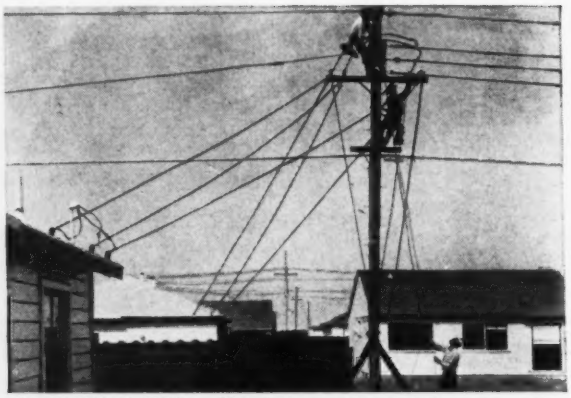
ROME CABLE CORPORATION,
Dept. EW-6, Rome, N. Y.
Please send me a copy of the Rome Power and Control Cable Catalog.

Name.....
Company.....
Address.....
City..... Zone..... State.....

GET THE BEST WITH ALUMINUM CONDUCTOR



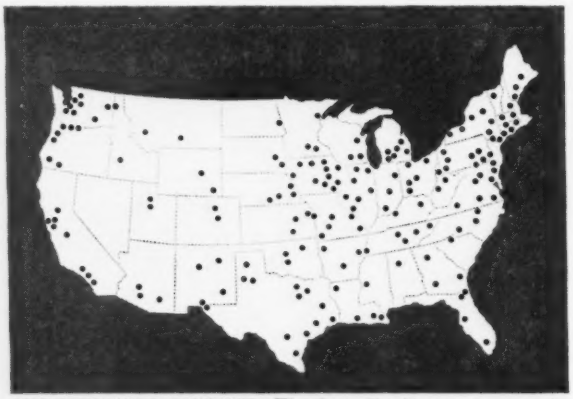
AUTOMATIC SAVINGS—Aluminum conductor provides *immediate, automatic savings* because aluminum costs far less than copper. And faster, lower cost installations are made possible because aluminum's light weight makes it much easier to transport, handle, string.



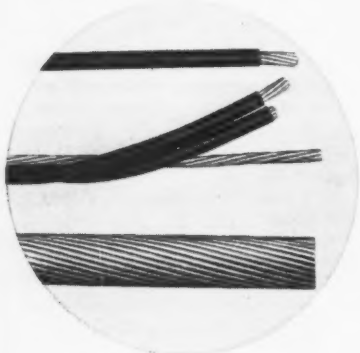
CONTINUING SAVINGS—Aluminum conductor helps cut repairs with lower tensions on house and pole, lower ice and wind loadings. On distribution lines and services the tough neoprene or polyethylene coverings increase life. Total savings possible when using covered aluminum conductor—*a whopping 35%!*

GET THE BEST... PLUS! WITH KAISER ALUMINUM CONDUCTOR

TOP ENGINEERING SERVICE—*1. On-the-job field service* by experienced linemen who make detailed inspections, offer stringing assistance. *2. Unsurpassed engineering help* by qualified engineers who make careful studies of your problems, provide sag-and-tension charts on request. 3. *Laboratory service* by the fully-staffed, fully-equipped laboratories of Kaiser Aluminum.



BEST DISTRIBUTOR COVERAGE—The best distributor coverage in the industry means that there's a Kaiser Aluminum conductor distributor conveniently located to serve you. His many services include: large stocks of Kaiser Aluminum conductor, fast delivery to help reduce your inventory, up-to-the-minute information, friendly, personal attention on any size order.

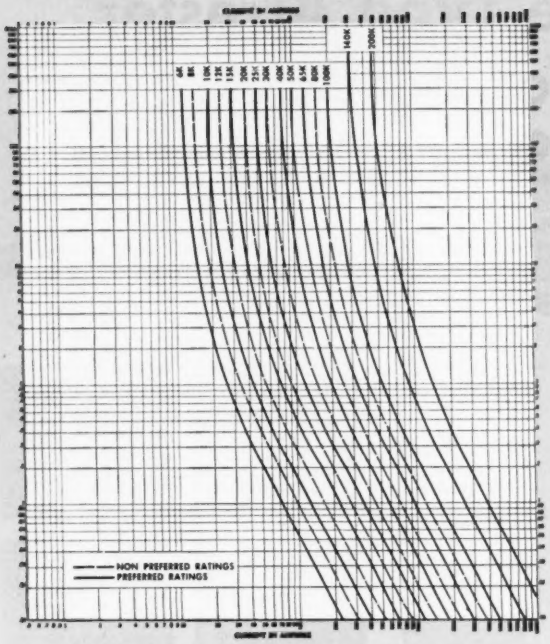


ACT NOW! The extra advantages of *complete service* are yours at no obligation when you specify Kaiser Aluminum conductor. Send for complete engineering data on new Kaiser Aluminum covered conductor—both weatherproof line wire and self-supporting Triplex cable for service drops and secondary distribution lines. Contact any Kaiser Aluminum office in principal cities, or one of our many distributors. Kaiser Aluminum & Chemical Sales, Inc., Oakland 12, California.

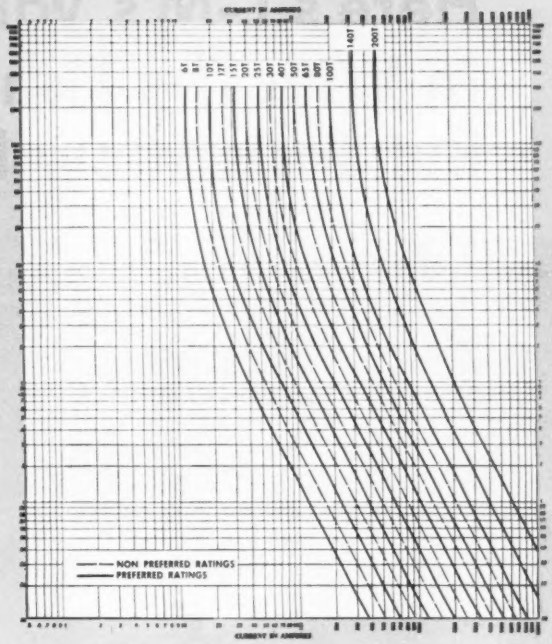
Kaiser Aluminum

setting the pace . . . in growth, quality and service

Neoprene and Polyethylene Covered Conductor, Solid and Stranded • Self-Supporting Triplex Cable • ACSR • All Aluminum Conductor



"K" (fast) Links—minimum melting curves. Speed ratios vary from 6 to 8.1.



"T" (slow) Links—minimum melting curves. Speed ratios vary from 10 to 13.

Large size copies of these curves available from L-M on request

L-M Makes Available Complete Line Of New EEI-NEMA–Standard Fuse Links

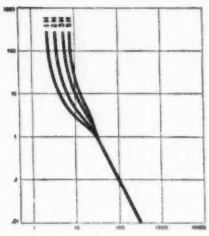
By **R. D. Cleaves**
Manager
Protective and Switching
Equipment Sales
Line Material Company

A joint project between users, represented by EEI, and manufacturers, represented by NEMA, has recently resulted in the establishment of definite time-current characteristics for fuse links. These have now been adopted as standard by the industry, in sizes covering all major operating requirements.

As a major fuse link manufacturer, Line Material Company has now made available a complete line of links meeting the new standards. L-M's new EEI-NEMA Fuse Links offer you these benefits:

1. **Industry-standard mechanical and electrical interchangeability, with assurance of uniform degrees of coordination between adjacent link sizes.**
2. **Two speeds—"K", fast, and "T", slow —with time-current characteristics to meet all major operating requirements.**
3. **Better coordination with reclosers covering a wider range of fault currents.**
4. **Simplified purchasing, stocking, and application.**
5. **Positive performance, precise electrical characteristics, and guaranteed quality.**

New L-M High Surge Links for sizes below 6 amperes



L-M High Surge Links —minimum melting curves

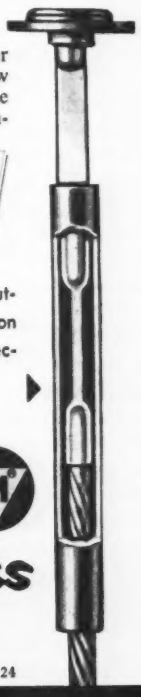
Today transformers are frequently worked up to their maximum thermal capacity. In protecting from overload, the protecting fuse link should remove the transformer from service whenever this capacity is exceeded. But it is important that the fuse link does not blow from surges and momentary overloads, causing needless outages and service trips.

Links large enough to stand these surges will not give adequate overload protection. Therefore L-M has provided a line of High Surge Links in 1, 2, 3, and 5 ampere sizes, which will stand the momentary inrush currents, and yet provide adequate protection.

These links have characteristics similar to 1, 2, 3, and 5 ampere N-rated links on the low current end, and 10 ampere N links on the high current end. These L-M High Surge Links allow good coordination with either the 10-"K" or 8-"T" EEI-NEMA links; and they supplement the EEI-NEMA-standard line.

Get Full Information

Ask the L-M Field Engineer for details and copy of new Bulletin FC5A. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



Rating clearly marked on button. One-piece forged button and shank. Horn fibre protective tube. Die-cast tin fusible section.

LINE MATERIAL

fuse cutouts and fuse links

It's Time to Roll Up Your Sleeve—Give Blood Now

Here's L-M's Valve Type Arrester In With The Fish For 30 Days... But Tests Show It Stays Dry Inside

L-M 3 kv Valve Type Arrester in the goldfish bowl where it has been under water for 30 days. Test data and oscillograms show that even complete submersion for this period in no way reduced the arrester's ability to render safe, long-time protection. Even the slightest trace of moisture would have been evident from the test results. There wasn't any!

By R. D. CLEAVES
Manager, Protective and Switching Equipment Sales
Line Material Company

Started originally as something of a "gag," our goldfish bowl test demonstrates clearly the complete moisture-sealing of L-M valve type lightning arresters.

In a spirit of good clean fun, we tested a stock L-M arrester and put it into a big goldfish bowl as a sales conference stunt—just to show L-M Field Engineers that goldfish couldn't get inside of it. But we left the arrester, completely submerged in the tank of water, for 30 days. Then we repeated the same tests made originally on the arrester.

At the end of the 30-day period, the lightning arrester was in good operating condition. It had the same characteristics as it had originally, as shown by our laboratory's test data and oscillograms at the right. There was absolutely no moisture leakage.

You'll probably never try to operate an L-M valve type arrester under water. But you can be sure that prolonged rain or humid air will never affect its operating characteristics. For L-M arresters are completely and permanently sealed against moisture, and retain their operating characteristics without change for many, many years.

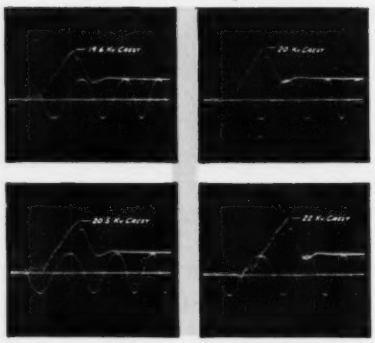
Get the Whole Story on L-M Valve Type Arresters

L-M arresters have many features that contribute to their ability to protect other apparatus without fault. The precision gap is heavily built, with electrodes machined out of solid brass bars. The valve element is molded directly into the housing, filling it completely and solidly. Lens-shaped electrodes distribute surges evenly through the element, resulting in maximum surge capacity. The Isolator, an L-M-patented insurance feature, guarantees that no matter what happens, the arrester will never ground feeders.

Get the whole story. Ask the L-M Field Engineer for Bulletin LA-2. Or write direct to Line Material Company, Milwaukee 1, Wis. (a McGraw Electric Company Division).

BEFORE **AFTER**

1. Front of Wave Sparkover



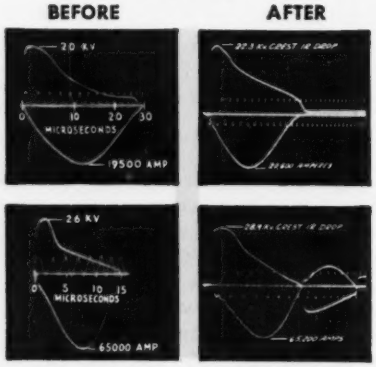
Oscillograms of two impulse sparkover tests before (left) and after (right) show no change in the protection offered by the arrester after 30 days in the goldfish bowl.

2. 60 Cycle Sparkover and Radio Noise

Both before and after the 30-day test, the arrester was noise-free through the sparkover voltage of 7 kv rms.

3. IR Drop

BEFORE **AFTER**



On both 20,000 and 65,000 ampere surges, the arrester showed no change in IR Drop from the surge tests made before the demonstration.

4. Discharge Current Withstand

After the demonstration, the arrester was given five shots of 65,000 amperes each. These caused no damage.

LM®

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LINE MATERIAL
Lightning Arresters

Completely hook-stick operated. Fuse cartridge can be removed or replaced with standard head switch stick.

L-M's Type HXO Power Fuse Cutout Interrupts up to 20,000 Amperes

Double-Venting: replaceable fuse link button closes top of tube; on low-amperage faults, the tube vents at bottom only; on high faults, pressure releases button at top, giving double-venting. This insures successful interruptions on both low and high fault currents.

Rated at 200 amperes, with interrupting capacities as follows:

20,000 amps at 7.5 kv
15,000 amps at 15 kv
9,000 amps at 23 kv
5,000 amps at 34.5 kv
4,000 amps at 46 kv

These interrupting capacities apply for full range of fuse link sizes from 1 ampere through 200 amperes.

Replaceable Power Fuse Link

Field-replaceable E-rated power fuse links, similar in design and construction to those used in distribution cutouts. No cartridges to replace, no filler tubes to buy. Designed for positive corona-free operation at high currents and voltages. Ratings and performance meet NEMA Power Fuse Standards.

L-M Power Fuse Links cost only $2.60 each (smaller sizes $1.60) compared to other cutouts requiring complete cartridges at $10 or more. Sizes from 1 to 200 amperes.

Get Full Information on the HXO

Ask the L-M Field Engineer for details and bulletin, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

fuse cutouts

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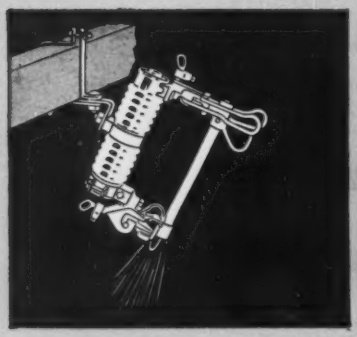
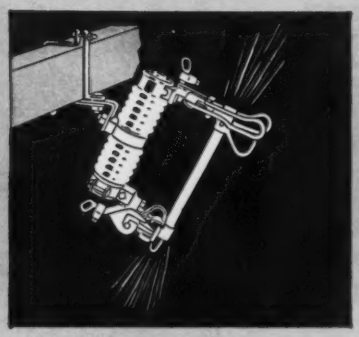


On Low Amperage Faults

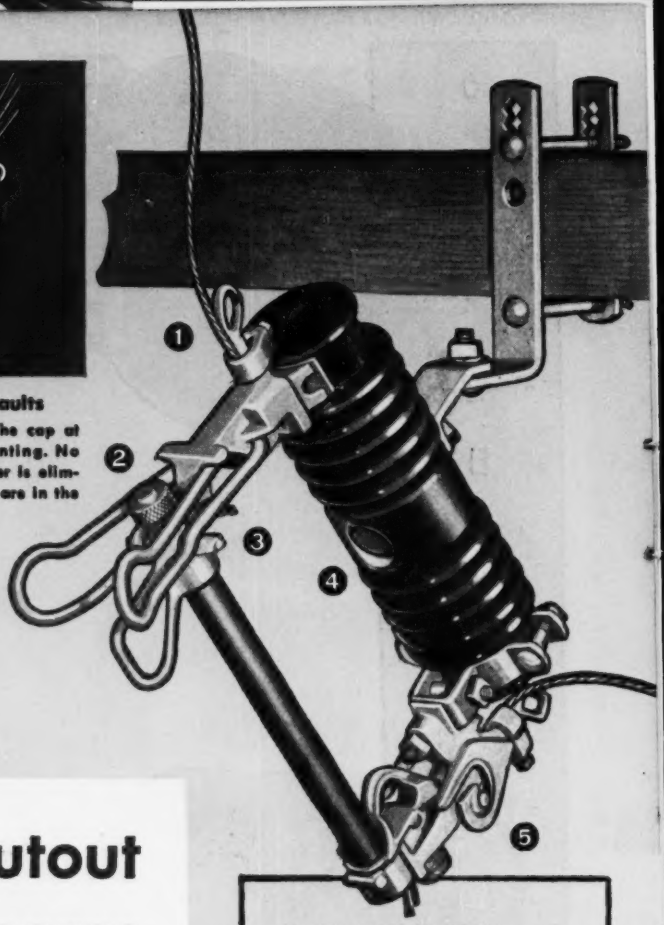
single venting, at bottom only, provides ample pressure to expel the arc and the fuse link, before the tube drops down. In this case, only the fuse link needs to be replaced, not the cap.



On High Amperage Faults

pressure automatically opens the cap at the top to provide double venting. No bursting of tubes. Gas flashover is eliminated because no cutout parts are in the path of gas discharge.

This expendable cap acts as an automatic escape valve. On low faults it remains undisturbed. On heavy faults the top opens, as shown at right, relieving the pressure.



L-M's "HCO" Fuse Cutout Provides 8000 Amperes Interrupting Capacity

For the first time, high interrupting capacity is available at low cost, in L-M's new open type distribution cutout. The increased interrupting capacity of the "HCO" is available at only about $3 more than the price of standard duty open type cutouts. This makes the "HCO" the lowest priced cutout of its type.

The "HCO" is ingeniously designed to handle both low amperage and high amperage faults equally well, with standard distribution fuse links.

This is accomplished by the automatic pressure-controlled expendable cap at the top of the tube. On low amperage faults, the cap remains intact, confining the pressure and providing bottom venting only. On high amperage faults, the diaphragm in the cap opens, relieving the pressure by providing double venting.

The "HCO" is completely bird-proof. The tube can be removed and replaced with the standard head hook-stick. It takes standard distribution fuse links.

Get details from the L-M Field Engineer; or write for Bulletin. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Rated at 5, 7.5, and 15 KV, 100 amperes.

NOTICE THESE FEATURES

1. Rated at 5, 7.5, and 15 kv, 100 amperes, with 8000 amperes interrupting capacity using any size standard universal fuse links.
2. Expendable cap acts as automatic pressure-controlled vent to provide double venting on high amperage faults.
3. All current-carrying parts are silver plated.
4. Completely bird-proof design.
5. Heavy, closely fitted L-M—patented double hinge takes all the recoil forces. Top contacts not stressed by recoil. In reclosing, the hinge guides the tube directly between the contacts—it can't miss the top contacts.

The expendable caps, replaced only when the link blows on a high amperage fault, are economical, easily replaced. They are supplied in a cloth bag, carried with the fuse links.

LINE MATERIAL LM

fuse cutouts and fuse links

L-M's NEW PID
5 KV 100 ampere
intermediate duty cutout.
Reflective markings easily seen from the ground identify the door and cutout. Doors are easily removed and replaced with a switch stick, for safety.
Cutout rating and date of manufacture sandblasted into side of box for permanent identification.
5000 V
100 A.
LM-52

L-M's New PID Cutout Provides Up To 166% Higher Interrupting Capacity At 20% Lower Cost

Costs 20% less than standard 100 ampere cutout; interrupting capacity 166% higher at 2.5 kv (8000 amperes), 66% higher at 5 kv (5000 amperes). Box will accept all standard 50 ampere doors, thus permitting one box to be used for both 50 and 100 ampere service. Also takes 200 ampere switch blade door.

L-M's PID Cutout is designed to provide a 100 ampere intermediate duty cutout at an appreciable saving over standard 100 ampere cutouts. Boxes are smaller and more compact than standard 100 ampere cutouts—they are the same size as a 50 ampere cutout but terminals and contacts are heavier. Thus the cutout will take any of L-M's 50 ampere doors, as well as the 100 ampere intermediate duty and 200 ampere switch blade door.

The non-disconnecting door provides positive link ejection and circuit interruption even on low current faults.

Both cutout and switch blade doors can be removed and replaced with standard switch sticks, providing additional safety.

Cutout and disconnect switch doors are easily identified from the ground by the reflecting markings on the doors. Rating and date of manufacture are sandblasted into sides of box for permanent identification.

Get Details on L-M Fuse Cutouts

L-M offers complete families of open and closed type cutouts to meet a wide range of requirements. Interchangeable doors offer low first cost and economical capacity increases as loads are increased. For complete information ask the L-M Field Engineer or write for bulletins. Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL
fuse cutouts

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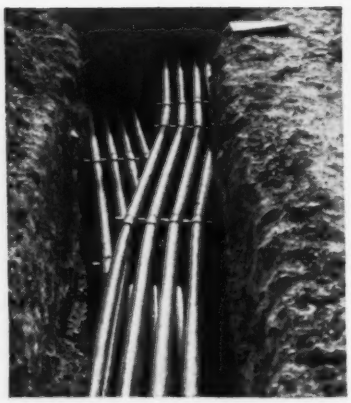
Complete Coordinated Equipment for Distribution Today

ORANGEBURG QUALITY FEATURES

Orangeburg Fibre Conduit is non-metallic — does not corrode. Lasts indefinitely. Impermeable walls and tight joints keep out corrosive ground waters. Smooth bore and low coefficent of friction protect cables from sheath abrasion. Resists acids, alkalis, salt, grease, oil. Tough, resilient. Lays faster at lower cost than any other type of conduit.



STANDARD *is installed with concrete encasement. Preferred for banks of three or more ducts.*

NOCRETE *is installed without concrete encasement. Extra heavy wall for direct burial—practical for many single or double duct runs.*

Utility Engineer's Standby For 60 Years

Leading public utilities and municipalities have used Orangeburg Fibre Conduit extensively for years. It's helpful to know why. The *long-term* protection that Orangeburg gives to cables underground helps the Electrical Industry to keep the *power flowing*—and *saves money* by prolonging cable life. Orangeburg also saves money in every phase of installation. The *standard fittings* supplied for *Orangeburg Conduit* likewise cut down costs by *simplifying installation.* Send to Dept. EW63 for complete catalog. Orangeburg Manufacturing Co., Inc., Orangeburg, New York.

ORANGEBURG® **STANDARD** WITH CONCRETE
NOCRETE WITHOUT CONCRETE

FIBRE CONDUIT

Graybar ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

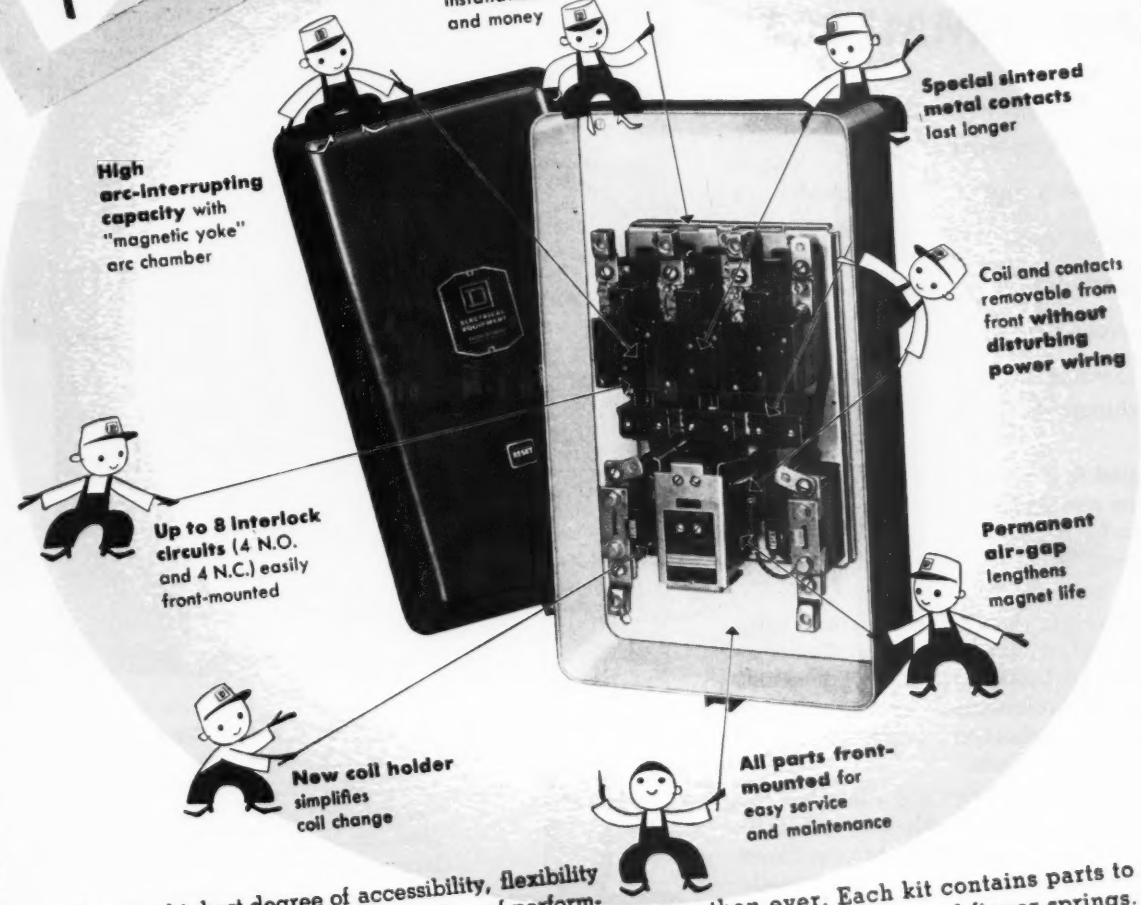
BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

NEW Square D Size 4 Starter

Feature-packed!


"Hook-on" base design saves installation time and money
Special sintered metal contacts last longer
High arc-interrupting capacity with "magnetic yoke" arc chamber
Coil and contacts removable from front without disturbing power wiring
Up to 8 interlock circuits (4 N.O. and 4 N.C.) easily front-mounted
Permanent air-gap lengthens magnet life
New coil holder simplifies coil change
All parts front-mounted for easy service and maintenance

The highest degree of accessibility, flexibility and compactness—with no sacrifice of performance and long life. That's Square D balanced design—and you'll find it in every size Square D starter.

"Off-the-Shelf" Parts Kits, another Square D convenience feature, make normal maintenance easier than ever. Each kit contains parts to replace all load contacts and finger springs. Electrical interlocks also available in kit form.

Write for Bulletin 8536, Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin

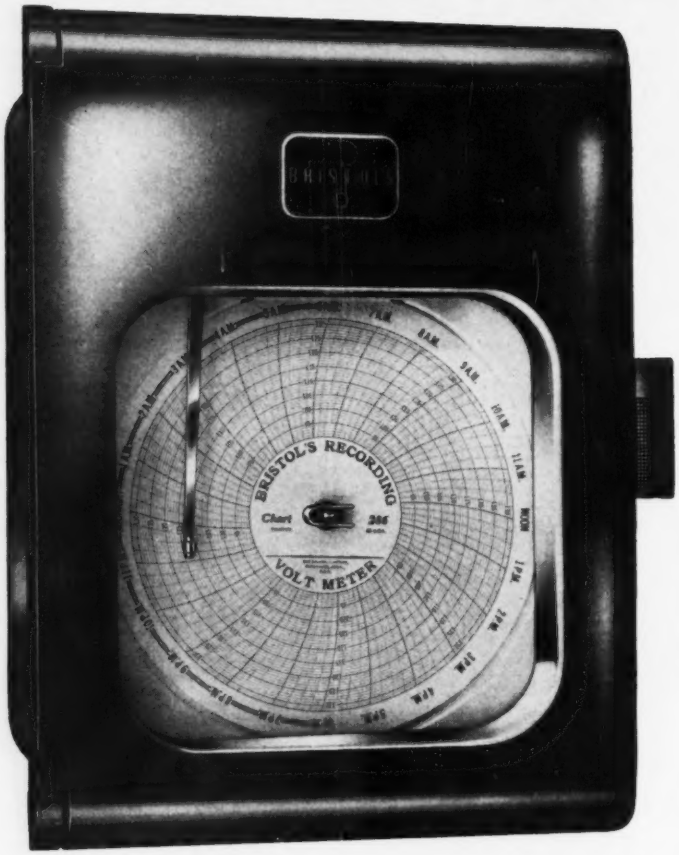
ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

1903 • 50 YEARS OF DESIGN LEADERSHIP • 1953

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS



1. Low burden—the lowest burden of any round-chart recorder on the market.

2. Extremely high torque gradient.

3. Temperature compensated.

4. Shock-proof moving element mounting.

5. Leveling of instrument not critical.

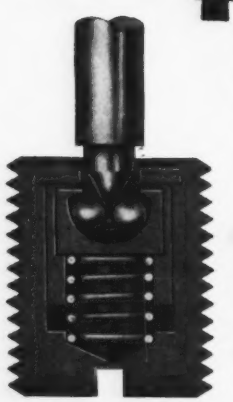
6. Continuously legible recording on sudden changes—up to full scale value.

Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.



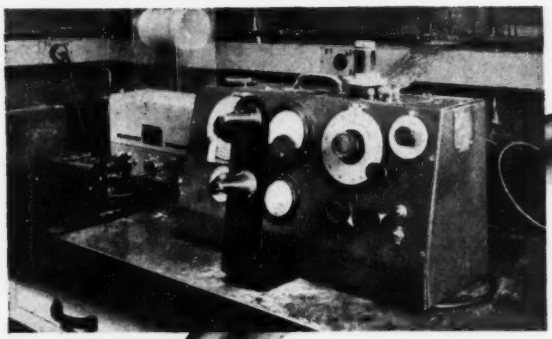
Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

BRISTOL

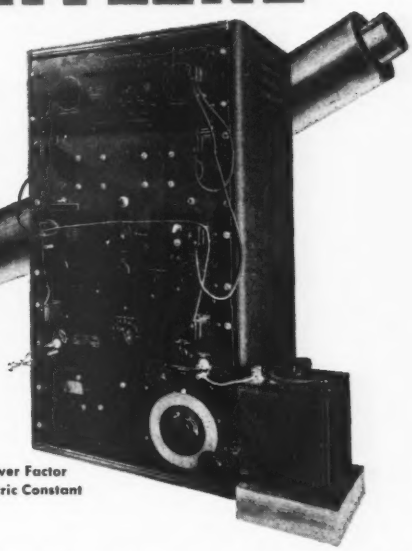
The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS



Testing Insulation Resistance

Compare the electrical properties of BAKELITE POLYETHYLENE TRADE-MARK with other wire covering



Testing Power Factor and Dielectric Constant

Continuous laboratory testing proves that BAKELITE Polyethylene has superior electrical properties for signal and service drop cable.

For instance, its insulation resistance between 15½ deg. C. and 105 deg. C. is tested on the apparatus on the right. The insulation resistance is too high to measure on conventional testing devices. The apparatus above tests power factor and dielectric constant from 1000 cycles to 50 megacycles at room temperature. At 50 megacycles and 25 deg. C., the power factor of black BAKELITE Polyethylene is only 0.004, dielectric constant only 2.5. These values hold through the range from 60 cycles to 5 x 10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on the electrical properties of BAKELITE Polyethylene. It excels in resistance to voltage breakdown, even after long-continued water-immersion.

BAKELITE Polyethylene possesses outstanding durability. It resists chemicals, water immersion, and abrasion. Extruded on wire, it won't festoon. Ten years' outdoor weathering data and accelerated laboratory aging of black polyethylene compound indicate a long service life.

For line wire use, it meets ASA suggested specifications (second draft: July 20, 1952) for weather-resistant wire and cable. It stays flexible down to –70 deg. C., resists deformation up to 90 deg. C. With a specific gravity of only 0.94, BAKELITE Polyethylene weighs less than any other line wire covering. In addition, it can be used as a thinner covering—normally 1/64 in. less wall thickness—because of its superior physical and electrical properties. As a result, it can be hung over longer spans, and is easier to handle, making stripping and splicing faster. Its smooth waxlike finish speeds pulling over crossarms.

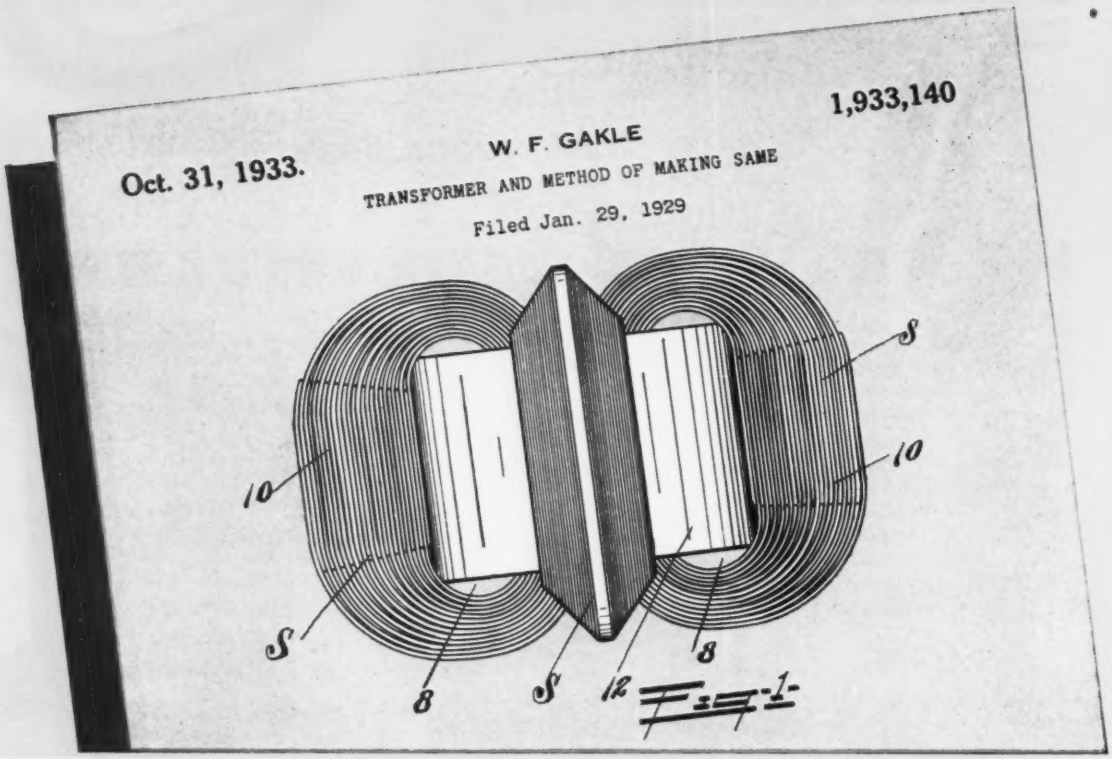
Compare BAKELITE Polyethylene with other wire coverings. Detailed information is available in Kabelitems #48. For your free copy, write Dept. QT-63.

BAKELITE
TRADE-MARK
POLYETHYLENE
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC **30 East 42nd Street, New York 17, N. Y.**
***In Canada:* Bakelite Company (Canada) Ltd., Belleville, Ontario**

THIS IS THE 20TH

KUHLMAN Patent No. 1,933,140



Patent No. 1,933,140 was the first of the modern core designs.

Predating all other modern core forms, the Kuhlman Electric Company in 1929 applied for a patent on a radically different core design that improved the magnetic circuit and reduced substantially the weight of transformers. This was Patent No. 1,933,140—the original Bent Iron Core.

The patent was granted in 1933. For two years thereafter Kuhlman experimented further to make this core suitable for production. Then in 1935 the first Bent Iron Core transformer was put on the market. For the following three years it was the only core of its kind available to the electrical industry.

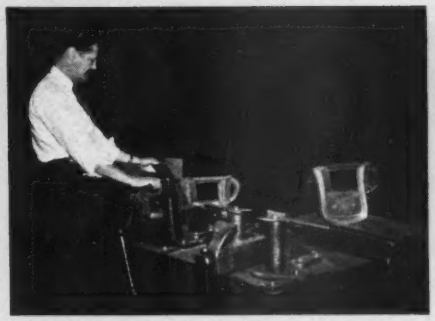
About 1938 cold-rolled, oriented grain, silicon steel was introduced to industry. Kuhlman engineers were quick to realize the advantages of the Bent Iron Core in fully utilizing the characteristics of this steel. Cold-rolled silicon steel provides a natural path for the magnetic flux in the core. This results in a reduction of exciting current by as much as 75%, and provides a further weight reduction. But, in order to obtain these advantages, it is necessary to construct the core in such a way that the magnetic flux can follow a continuous path parallel to the grain of the steel through a minimum number of air gaps.

This was no problem for Kuhlman. The Bent Iron Core had been constructed in just that way for the previous five years. There can be no doubt, then, that the Bent Iron Core—patented in 1933—20 years ago—is the forerunner of all magnetic improvements in modern transformers.

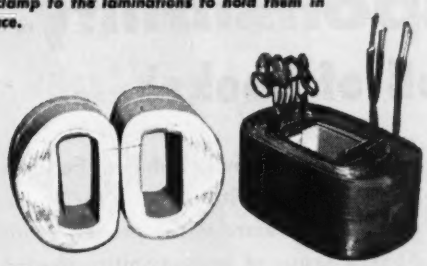
ANNIVERSARY OF

HERE'S HOW IT'S MADE

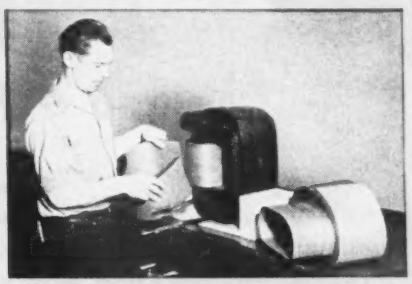
First, the laminations are cut to size and stacked. The operator clamps the stacks onto a hydraulic folding machine which bends them over a form into a U-shape. Before removing the pressure, the operator applies a clamp to the laminations to hold them in place.



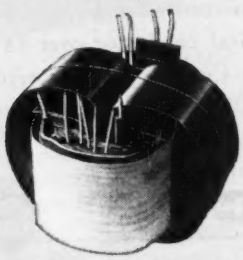
Another operator completes the bending by overlapping each alternate lamination. Levers on each side of the vise hold down each lamination as it is folded into place. The inner laminations have been cut shorter so that the outer ones will overlap.



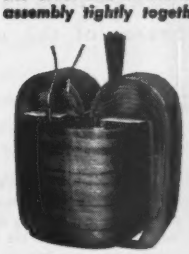
After the cores have been bent they are bound with wire and annealed to relieve the stresses caused by bending. Here are two annealed Bent Iron Cores next to the coil to which they will be assembled.



The assembler has disassembled a core and is now filling the coil lamination by lamination. The laminations retain their shape because they have been annealed. As soon as he has assembled a core to the other side of the coil, he will bind the whole assembly tightly together.



Here is a completed Bent Iron Core and coil assembly. The four air gaps of the old butt type core have been reduced to two, and the magnetic flux will always flow parallel to the grain of steel, never crossing it.



This is a recent variation of the Bent Iron Core, known as the BIE. Notice that the laps are at the top rather than at the sides. This allows for the manufacture of Bent Iron Core transformers of higher KVA rating without increasing the overall size of the transformer.

Kuhlman **ELECTRIC COMPANY, BAY CITY, MICHIGAN**
CRYSTAL SPRINGS, MISSISSIPPI

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,*
50 Church Street, 15th Floor, New York 4, New York. Cable Address: Microphone, N.Y.

ALCOA

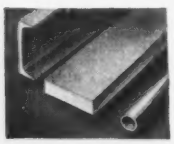
Responsibility...

and a fist full of books!

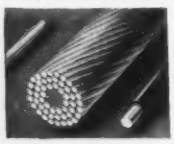
Alcoa currently publishes hundreds of booklets and pamphlets—over twenty-five dealing with aluminum electrical conductors alone. Their subjects range from products to procedures, their titles from *Aluminum Bus Conductors* to *Voltage-Drop Charts for Insulated Aluminum Cable.* You'll see them on the desks of men in all phases of the electrical power industry.

At first blush, publishing seems a far cry from the aluminum conductor business. For many companies, it is; but not for Alcoa. This technical literature is the printed product of Alcoa's sense of responsibility toward customers. A responsibility to help them make the best use of the best product. A responsibility we assumed when we introduced aluminum electrical conductor over 55 years ago. Aluminum Company of America, 2100-F Alcoa Building, Pittsburgh 19, Pennsylvania.

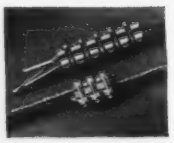
Alcoa Aluminum Bus Conductors are available in rectangular bars, solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include Aluminum Cable Steel Reinforced, solid and stranded aluminum wire, bare and covered.



Alcoa manufactures aluminum accessories correctly designed for use with aluminum conductors.

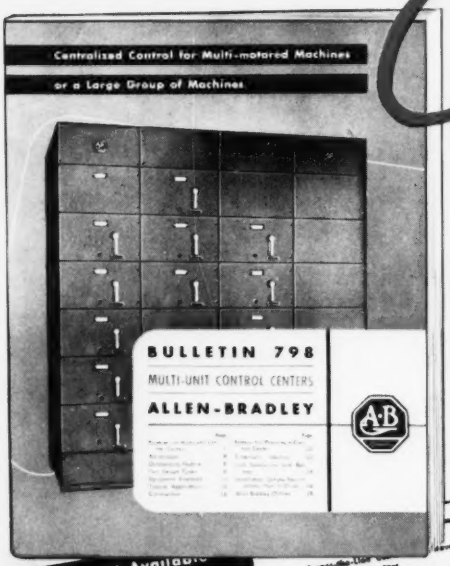


Alcoa Aluminum

ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow—CBS-TV every Sunday—brings the world to your armchair. Consult your newspaper for local time and channel.

Centralize



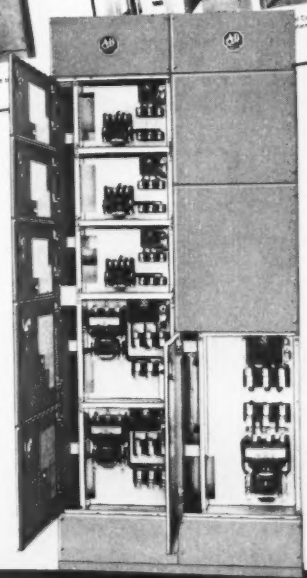
YOUR AUTOMATIC MOTOR CONTROLS FOR NEATER, SAFER INSTALLATIONS

There is a decided trend toward the use of Allen-Bradley Multi-Unit Control Centers. They concentrate all motor controls for a group of machines . . . or for your entire plant . . . in one spot. They make a compact installation that is safer and neater than scattered groups of individual controls. Inspection is centralized for easier and better maintenance.

SEND FOR THIS 28-PAGE ILLUSTRATED BULLETIN

This idea-packed catalog of Allen-Bradley Multi-Unit Control Centers has 58 illustrations and 18 diagrams of intriguing interest to plant engineers. It portrays how interchangeable panels of starters, reversing switches, circuit breakers, disconnect units, relays, and other control devices may be combined . . . just like building blocks . . . to provide precisely the control you need. Shows how easily changes can be made to satisfy revisions in plant layouts. Write for Bulletin 798, today.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.



4-53-M

A-B Quality

ALLEN-BRADLEY

BULLETIN 798 MULTI-UNIT CONTROLS

QUALITY

MULTI-UNIT CONTROL PANELS

EASY TO ADD
EASY TO CHANGE
to meet
Plant Requirements

Available with
Manual Disconnect Units
or Circuit Breakers

Plug-in panels are ideal for continuous process industries which must be serviced while the bus is "hot." Fixed connection Multi-Unit Control Panels are popular for most industries.

CENTRALIZED MAINTENANCE

Centralized location of all motor controls promotes regular inspection, discourages tampering by unauthorized personnel, and does away with special mounting provisions so often needed for groups of starters. A-B Multi-Unit Control Centers can be installed more quickly than an equivalent number of separate starters, disconnect units, and accessories.

GREATER PLANT SAFETY

Not only do Allen-Bradley Multi-Unit Control Centers reduce the hazards of accidental personal contact with "live" switch gear . . . they also make possible the centralizing of motor controls in rooms far removed from hazardous gases, dusts, or fumes. They may even be installed out of doors in weatherproof cabinets. Send for Bulletin 798 for details.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

4-53-M

A-B Quality

ALLEN-BRADLEY

BULLETIN 798 MULTI-UNIT CONTROLS

QUALITY

NEW LOW PRICES

SAVE UP TO $152.00

International Trucks are proved all 3 ways

You take the guesswork out of truck buying when you buy International trucks. They are proved all three ways to give you the performance you want at the *lowest* cost:

1. **Proved Before They're Built.** Before any International model goes into production, the right balance between design, costs, and performance is developed and proved at International Harvester's new truck Engineering Laboratory. The results—longer truck life, reduced operating and maintenance cost—give you more truck for your dollar.
2. **Proved After They're Built.** Economy, performance, and stamina of Internationals is proved again at the "Desert Whipping Post," 4000-acre Proving Ground in Arizona, under the most difficult operating conditions.
3. **Proved In Service.** In 1952, America's most cost-conscious truck operators bought 58% more heavy-duty Internationals than any other make, 27.3% of all heavy-duty trucks sold. Every new International truck, from ½-ton pickups to six-wheel off-highway models, embodies the advanced engineering principles that have kept Internationals the heavy-duty sales leader for 21 straight years.

See them. Compare them. Drive them. Ask your nearest International Dealer or Branch for all the facts.

Select the International That's Right for Your Job from America's Most Complete Truck Line.

168 basic models from ½-ton to 90,000-lb. GVW rating . . . 307 new features . . . 29 engines, with widest practical choice of gasoline, LPG or diesel power, available to give the right power for the job . . . 296 wheelbases . . . Transmissions and axle ratios to meet any requirement . . . Thousands of variations for exact job specialization.

INTERNATIONAL HARVESTER COMPANY • CHICAGO

Rolling shop on the job. New International Model R-120 with special service-utility body—77 and 89-inch lengths. 115 and 127-inch wheelbases. All compartments triple-sealed to keep out dust and moisture.

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

Better roads mean a better America

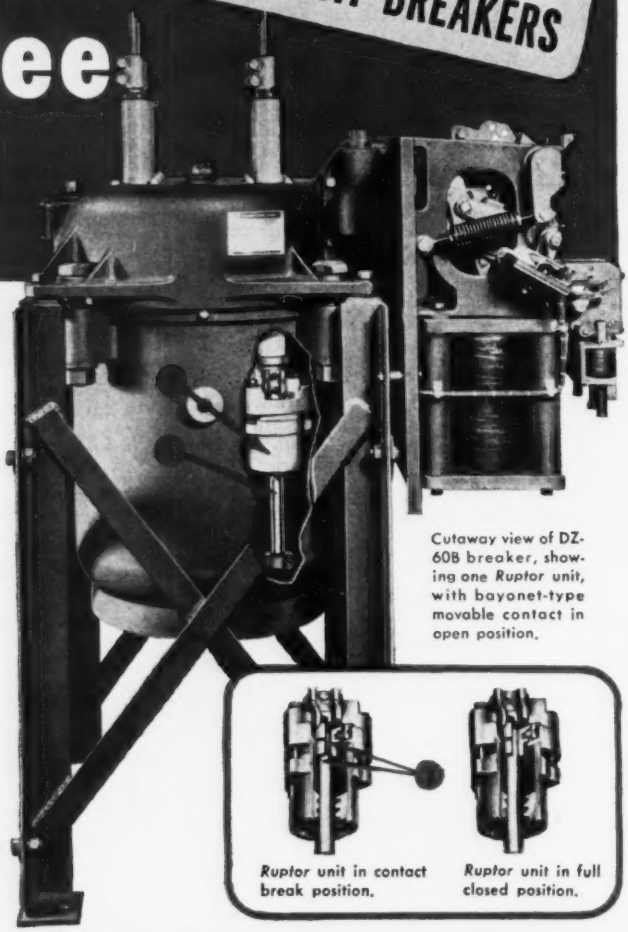
INTERNATIONAL TRUCKS

"Standard of the Highway"

Three Reasons Why

...Years of Trouble-Free Service

ALLIS-CHALMERS
Indoor
OIL CIRCUIT BREAKERS



Cutaway view of DZ-60B breaker, showing one *Ruptor* unit, with bayonet-type movable contact in open position.

Ruptor unit in contact break position.

Ruptor unit in full closed position.

One **Few moving parts!**

Bayonet contacts (1) are the only moving parts of the *Ruptor* interrupting device.

Two **Easy inspection!**

Drop the tank, and the bayonet contacts are visible in open position. For access to the stationary contacts, one needs only to remove four bolts and cylindrical shell (2).

Three **Self-aligning and Self-cleaning contacts!**

Tulip and bayonet contacts (3) maintain high conductivity without readjustment or cleaning. Arc energy is minimized by efficient interruption within oil-filled *Ruptor* unit. This in turn contributes to long contact life and low oil deterioration.

In addition, a mechanically trip-free solenoid operating mechanism controls contacts of time-proved *Ruptor* interrupting devices. And pole unit mechanism is self-lubricated — completely enclosed — sealed from dust, dirt, corrosion.

In brief, Allis-Chalmers DZ breakers are built to assure years of dependable, trouble-free service.

Allis-Chalmers power circuit breakers are available in ratings from 2.5 to 230 kv, with interrupting capacities from 15,000 to 10,000,000 kva, to meet all industrial and power company requirements. For more information, call your nearby A-C representative, or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4057

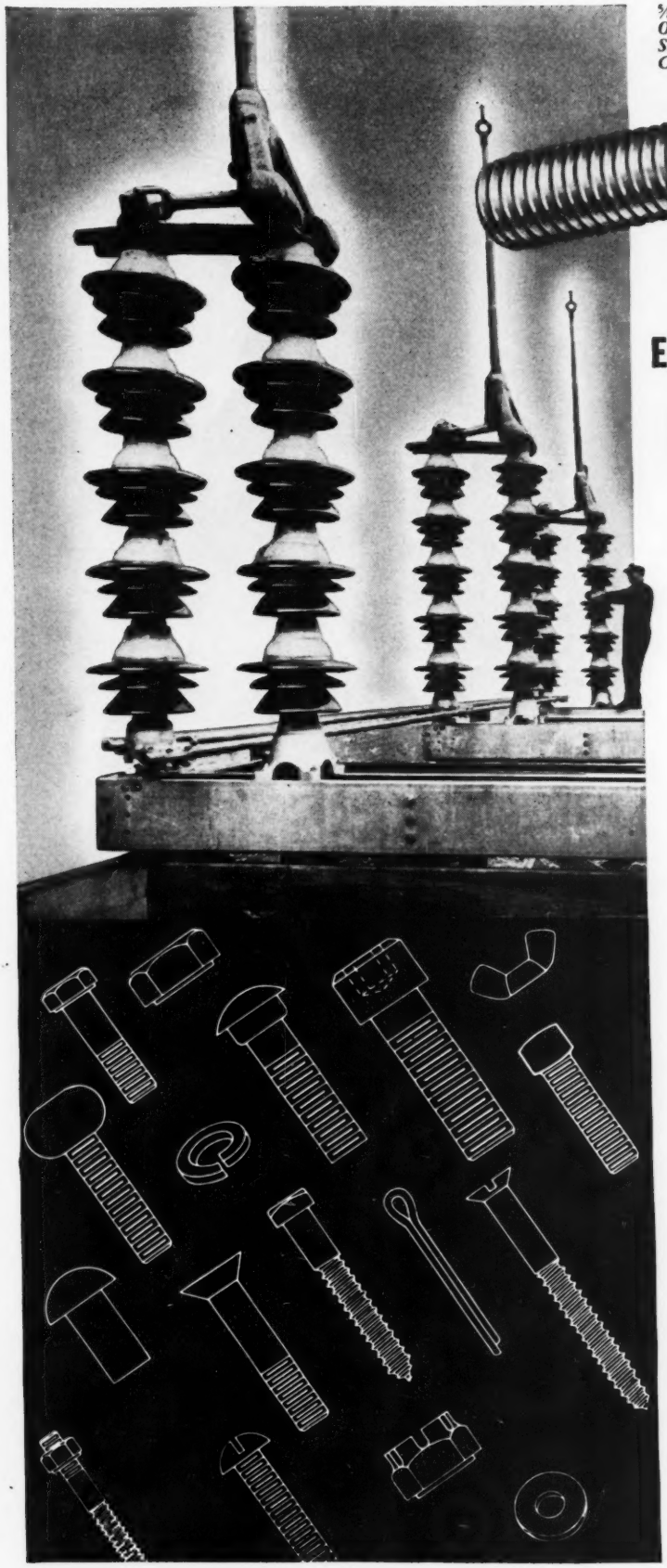
Ruptor is an Allis-Chalmers trademark.

TYPE	RATED KV	MINIMUM KV AT RATED KVA	RATED AMPS	KVA INT. CAPACITY
DZ-40B*	7.2	2.3	600	100,000
			1200	100,000
			2000	100,000
DZ-60B†	13.8	4.0	600	150,000
			1200	150,000
DZ-100B†	13.8	4.0	1200	250,000
DZ-200B†	13.8	6.6	1200	500,000
			2000	500,000

*Ask for Bulletin 71B6179. †Ask for Bulletin 71B6129.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS



⅝"—11 x 3
Oval Neck
Silicon Bronze
Connector Bolt

HARPER

EVERLASTING FASTENINGS

END CORROSION PROBLEMS

Costly electrical equipment . . . transformers —switches—connectors—insulators . . . must be guarded against corrosion's constant menace.

You protect this vital equipment—prolong its life—reduce maintenance costs with Harper Everlasting Fastenings that resist corrosion.

Connector bolts—carriage bolts—hanger bolts—lag bolts—machine bolts . . . nuts—machine screws—wood screws—washers—rivets—cotter pins . . . The H. M. Harper Company makes them all, in non-ferrous metals and all stainless steels, and Harper is the largest manufacturer in this field. Over 7,000 fastenings in stock—ready for prompt delivery.

Call the Harper Branch or Distributor in your area, or write for the Harper catalog.

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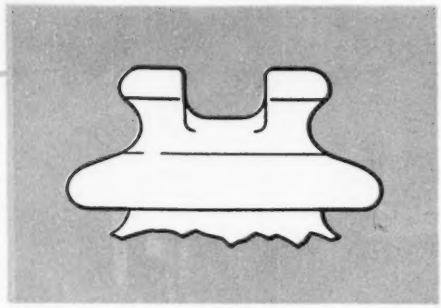
ALL STAINLESS STEELS

HARPER
EVERLASTING FASTENINGS

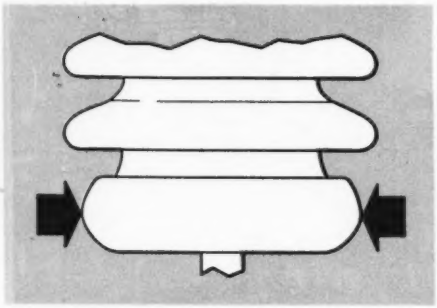
SPECIALISTS IN ALL
CORROSION-RESISTANT FASTENINGS

Lapp LINE POST



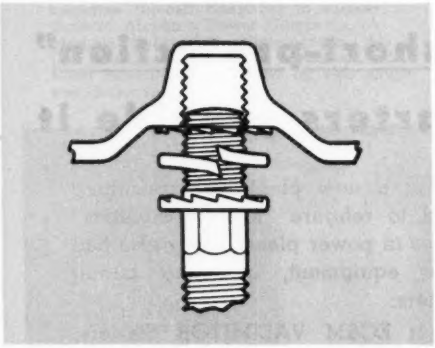
LARGER CONDUCTOR GROOVES

Improved wider square-side top-grooves—conforming to new EEI-NEMA standards—provides for conductor of any diameter up to 1½″. Holds conductor in top groove turning angles up to 15° (30° by using two insulators). With 45-Kv and smaller Line Posts, sharper angles may be turned by using side groove for conductor.



HARDWARE EXTERNALLY ATTACHED

Porcelain is approximately five times as strong in compression as in tension. In the Lapp Post design there are no nested porcelain parts or metal inserts which can load the porcelain in tension—or with any high-intensity local stresses. Hardware attachment is a cemented-on base, providing the safety of a large area, low-intensity compression grip.



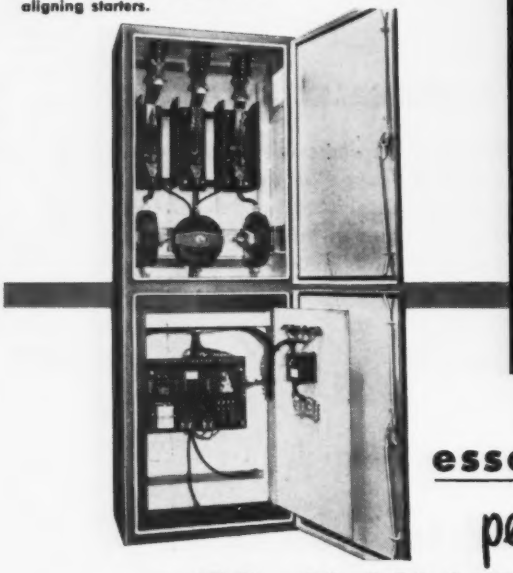
INTERCHANGEABLE STUD BOLTS

Stocking problems are reduced with the Lapp Line Post. Separable 7″ (for wood cross arms) or 1¾″ (for metal mounting) studs—or special lengths on order—are interchangeable for all units, and may be installed in the field. Serrated surfaces in the base and stud flange engage a "positive" lock washer—when the stud is tightened into the base a vibration-proof attachment is assured.

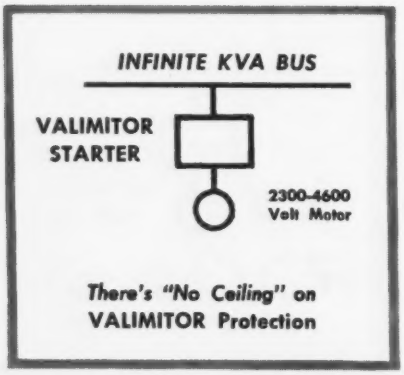
LAPP INSULATOR CO., INC., LE ROY, N.Y.

600-Ton Verson Hydraulic Press for forging 155 mm projectiles. EC&M VALIMITOR Starters provide continuous protection for the 2300 volt hydraulic pump motors serving several of these Verson All Steel Presses in a southern shell plant.

A typical 2300 volt EC&M VALIMITOR Cubicle Starter with self-contained bus at top for connecting all the adjacent self-aligning starters.



essential drives deserve *permanent* "short-protection" and EC&M VALIMITOR Starters provide it



write for T9-117 reprint bulletin

Recently, in the case of a new plant, the consulting engineers were obliged to refigure "short-possibilities" twice because of changes in power plans. They also had to re-check all power equipment, including circuit breakers and motor starters.

Then—they heard about EC&M VALIMITOR Starters, which offered an ideal solution to the knotty problem.

No more calculations . . . no worry about starters being outmoded by an unexpected increase in available KVA, now or in the future. Furthermore, these EC&M Starters could be ordered by specifying only the motor name-plate data —, and after being applied, there was no danger of getting caught "short" with a "short" the starters couldn't handle. EC&M VALIMITOR Starters give *permanent* protection. Investigate them for your 2300-4600 volt motor-drives.

THE ELECTRIC CONTROLLER & MFG. CO.
2698 EAST 79TH STREET • CLEVELAND 4, OHIO

ALMOST A QUARTER-CENTURY OF GOOD SERVICE...THEN EXIDE AGAIN

Exide-Manchex BATTERIES

Little more than 4 per cent a year for depreciation! That's what it cost the Alabama Power Company for the Exide batteries installed in two of their substations 21 and 23 years ago. Because of this long-life record and continued good battery performance, when replacement time came 'round, it was Exide again—Exide-Manchex, the dependable, money-saving battery that assures:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

• • •

Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services.

THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 2
Exide Batteries of Canada, Limited, Toronto

1888...DEPENDABLE BATTERIES FOR 65 YEARS...1953

"Exide" and "Manchex" *Reg. T.M. U.S. Pat. Off.*

Installations of new Exide-Manchex batteries (65-cell EME-15) in substations of Alabama Power Company. (A) Magella Substation, Birmingham, Ala. (B) Bessemer Substation, Bessemer, Ala. Each installation mounted on two single-row, 2-tier racks.

AMCRECO provides

Amcreco
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CROSS TIES • BRIDGE TIES • PILES •
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In an industry where so much depends on service, Amcreco offers facilities second to none. But even more important, these facilities are backed by wood preserving experience and know-how that results from nearly half-a-century's intensive study and research into wood preserving methods and problems.

Your requirements for treated materials can best be filled by an organization with the facilities and experience to provide you with efficient service and proved treatment and whose plants are strategically located for prompt domestic or export shipment. East of the Rockies, that means Amcreco. We hope to have the opportunity to quote on your needs.

AMERICAN CREOSOTING COMPANY

COLONIAL CREOSOTING COMPANY INCORPORATED
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GENERAL SALES OFFICE—CHICAGO, ILLINOIS
18 FIELD SALES OFFICES TO SERVE YOU

One of the largest network transformers ever built (2000 kva) being installed in vault at Pittsburgh's new Gateway Center.

How one Utility efficiently handled a 5-year 30,000-kva network increase.

Pittsburgh's tremendous load expansion over the past five years has been successfully met by sound network planning by the Duquesne Light Company.

Westinghouse Secondary Network Transformers played a large part in helping them do their job quickly and efficiently. Sizes varied from the nominal 500-kva rating at 216 volts wye, up to the unusually large 2000-kva rating at 480 volts—some of the largest network transformers ever built!

The reliability of network transformers is a necessary factor in any network system. That's why Westinghouse Network Transformers have continuously wound coils of sliverless copper to guard against hot spots, crystallization and punctured or scored insulation. That's why, too, they're liquid-filled under vacuum and have welded-on covers to assure a perfect seal.

What are your network transformer problems? Your local Westinghouse representative will be glad to discuss them. Call him today—or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70690

YOU CAN BE SURE...IF IT'S Westinghouse

Stewart Love, Pittsburgh Press

NETWORK SYSTEMS PAY IN

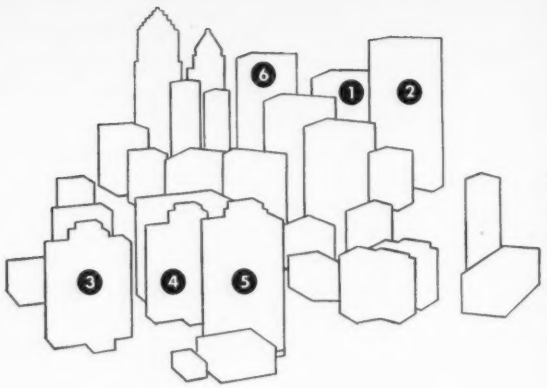
PITTSBURGH

The following locations are representative of the recent network installations in downtown Pittsburgh:

1) Carlton House Hotel
2) 525 William Penn Place Bldg., (Mellon-United States Steel)

3, 4, 5) Gateway Center Buildings No. 1, No. 2 and No. 3

6) Alcoa Building



A 10-time load increase . . . made possible by sound system engineering

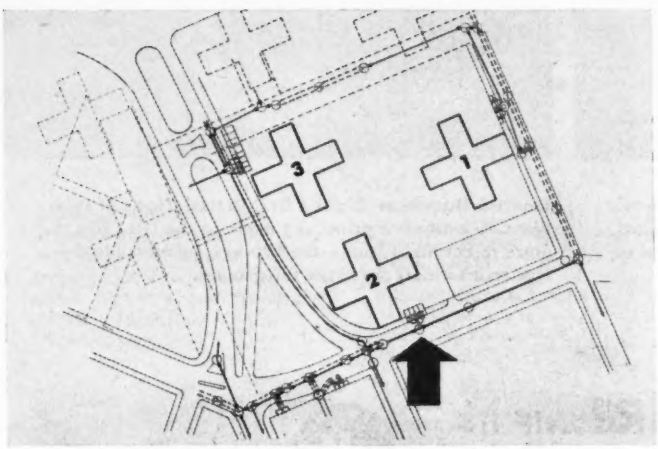
The dramatic reshaping of a new skyline in Pittsburgh is attracting national attention. Utility planners who face similar civic rejuvenation can appreciate the Duquesne Light Company's achievement in handling this load growth.

Duquesne Light actually began getting ready for this huge expansion in 1926, when they installed a secondary network to provide Pittsburgh's triangle with the highest quality service. Badly congested primary feeders and many small transformer installations were eliminated. As large commercial buildings were erected, network equipment was installed.

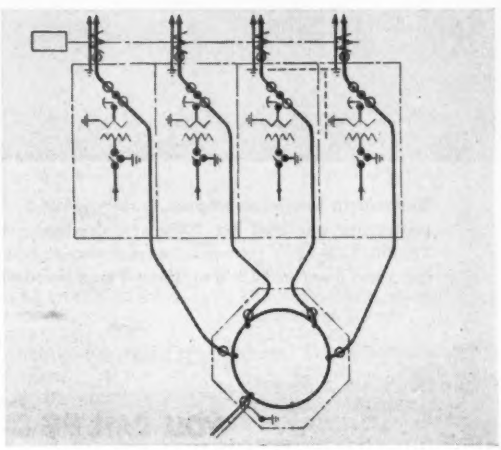
During the last five years, the network load has increased from 40,000 kva to 70,000 kva. In order to permit this growth, the Duquesne Light Company utilized a variety of network applications. A 4-unit network installation in the Alcoa Building, a 4-unit and a 5-unit network installation in the new United States Steel Building, and multiple unit network installation with street ties in the Gateway Center Group. These various systems employ both ventilated and submersible dry types, as well as liquid-cooled transformers.

The basic downtown network, installed 27 years ago, has grown to 10 times its original load . . . has proved flexible and adaptable in keeping pace with Pittsburgh's growth. The range of Westinghouse network equipment enables you to employ the type of network system that best suits your local needs. Westinghouse Engineers are ready to help in your network system planning. Call your nearby Westinghouse office or write Westinghouse Electric Corp., Post Office Box 868, Pittsburgh 30, Pa. J-97172

YOU CAN BE SURE...IF IT'S Westinghouse



Network secondary layout is shown for the present Gateway Center Buildings, No. 1, No. 2 and No. 3. This can be expanded to accommodate the additional buildings.



A typical network installation which serves Building No. 2 in the Gateway Center Group is shown in this single line schematic diagram.

Westinghouse Network Protectors have paced growth requirements

Available space for network protector installation and minimum maintenance characteristics are important considerations for any network expansion—particularly in a high-density, downtown area like Pittsburgh's Gateway Center.

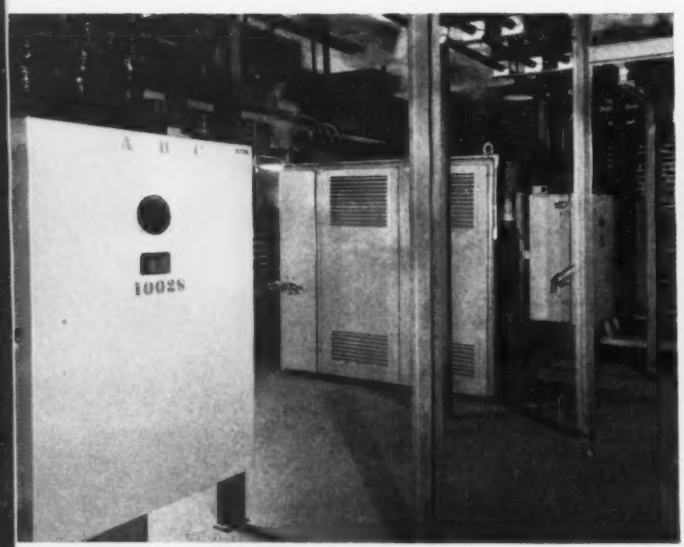
The Westinghouse Type CM-22 Network Protector, as used in accommodating Pittsburgh's growth, features "De-ion®" circuit breakers with reduced contact break distance, front-mounted, lever-type mechanism and smaller, yet more dependable, relays—all features resulting in overall protector size reduction.

Maintenance is minimized because the "De-ion" arc chamber reduces main contact duty. All adjustments are eliminated except relay settings. Dismantling the protector for inspection is facilitated with captive hardware throughout.

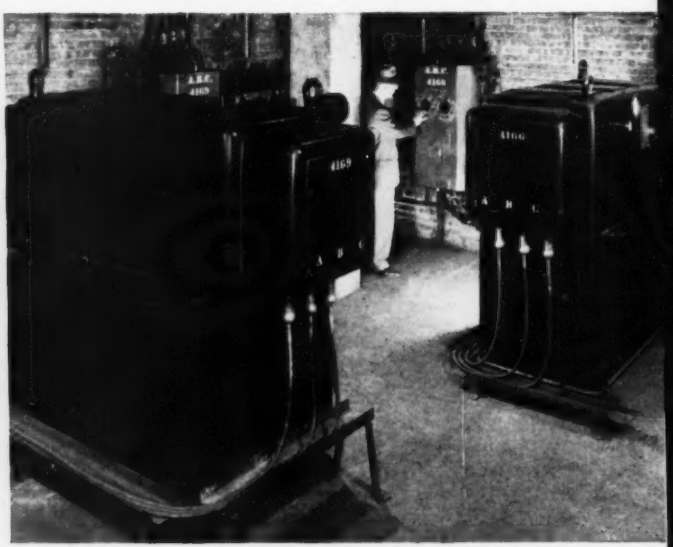
You, as Duquesne Light Company did, can realize the simplicity and convenience of these important Westinghouse features as you make plans to expand your network system.

Call your Westinghouse representative for more detailed discussion or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-60825



Three of the four 3000-ampere, vault-type CM-22 network protectors mounted on 1000-kva, dry-type ventilated, 12,000/125-216V network transformers as installed on the 32nd floor of 525 Wm. Penn Place Building.



One of Duquesne Light's first installations of subway CM-2 network protectors made in the late '20s. A more recent installation—the 300-kva, submersible dry-type transformers are in the foreground.

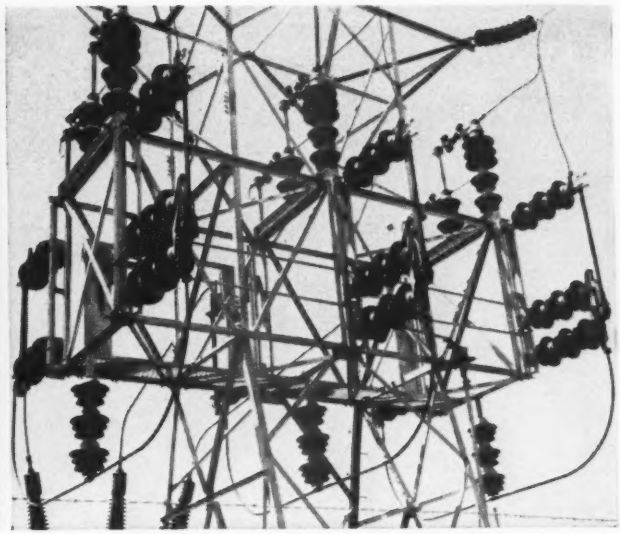
YOU CAN BE SURE...IF IT'S Westinghouse

Schwager-Wood Group Operated

VERTICAL BREAK SWITCHES TYPE TA

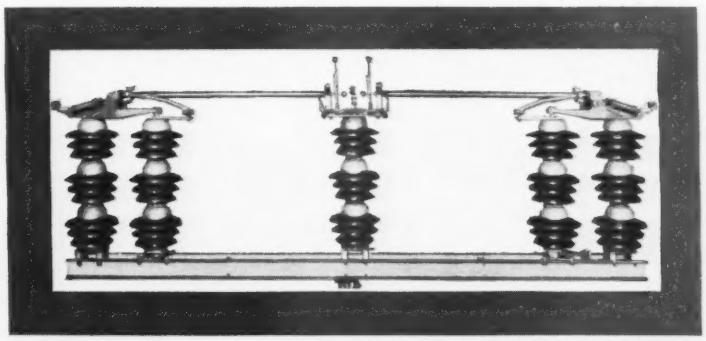
7.5 KV through 330 KV 400, 600, 1200, 1600, 2000 and 3000 Amperes

• Extra long breaking distance is achieved in the design of Schwager-Wood Type TA Switches by hinging the blade over the rear stack of insulators. This feature has contributed largely to their popularity. The increased breaking distance ranges from 75% in a 7.5 KV switch to 30% in a 115 KV, over a conventional design. Longer transmission lines can be dropped and heavier load or exciting currents can be interrupted than would be possible in switches with the blade hinged over the center insulating stack.



Illustrative of the versatility of Schwager-Wood Type TA Switches is the fact that the relocation of a single pin, in the counter balance mechanism, changes operation from horizontal to vertical—and vice versa.

Illustrated below is a Schwager-Wood Type TA single pole bus selector switch—115 KV—600 Ampere. Selector switches are available in all voltage and amperage ratings.



Technical information and prices available on request from any of our regional representatives or the home office, 8024 S.W. 35th Avenue, Portland 19, Oregon. Phone CHerry 7588

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447 American Life Bldg.
Walter E. Thompson Co.
Phone 7-1017

DALLAS, TEXAS
P. O. Box 8071
Jack D. Tate
Phone Lakeside 1473

DENVER, COLORADO
100 13th Avenue
Slaybaugh-Thompson Co.
Phone AComa 5826

DES MOINES, IOWA
5707 Waterbury Circle
Charles L. Ward Co.
George W. Swallow
Phone 7-4769

EL PASO, TEXAS
P. O. Box 347
Phillips Electric Eqpt. Co.
Phone 5-7933

KANSAS CITY, MISSOURI
3122 Roanoke Road
Charles L. Ward Co.
Phone VAlentine 8895

NEW YORK 7, N. Y.
125 Barclay Street
Russell D. Heath
Phone DIgby 9-1500

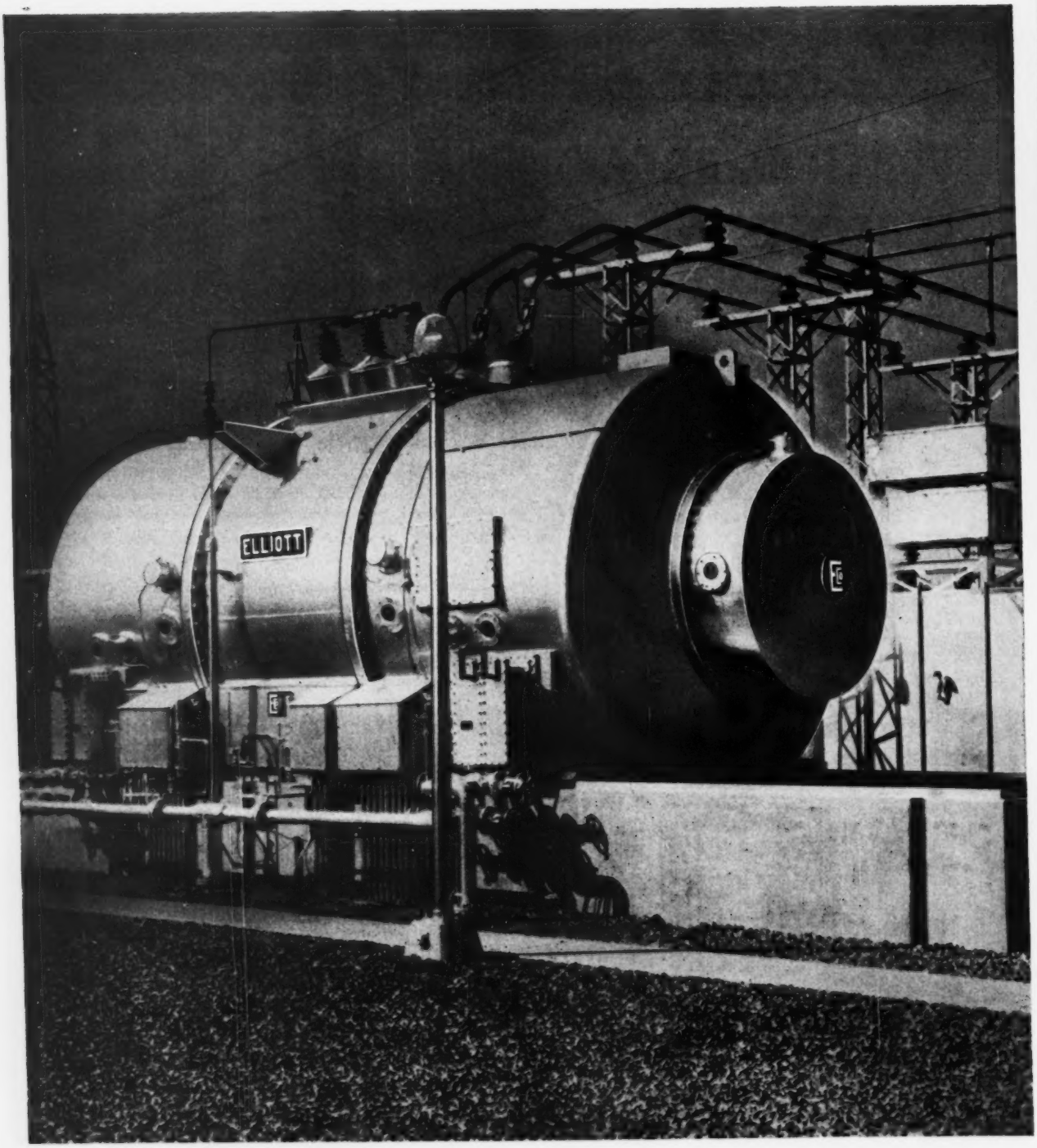
OKLAHOMA CITY, OKLA.
P. O. Box 8293
Charles L. Ward Co.
Harold E. Bates
Phone VIctor 3-3737

PASADENA, CALIFORNIA
P. O. Box 67-C
A. B. Smedley
Phone Sycamore 8-1174

SALT LAKE CITY, UTAH
550 W. 7th S.
Clarence W. Silver Co.
Phone 5-5378

SAN FRANCISCO, CALIF.
461 Market Street
K. M. Ryals Co.
Phone YUkon 2-5510

TACOMA 2, WASHINGTON
1914 Market Street
Love Electric Co.
Phone BR 4104

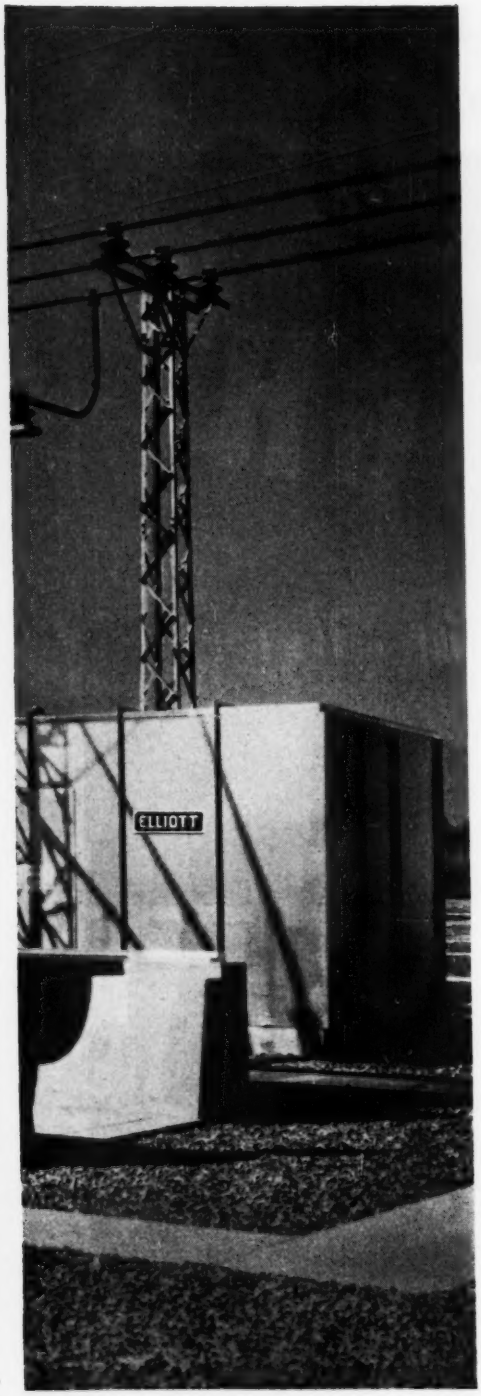


R3-5

The continuous rating of this unit is: 30,000 kva, zero power factor leading, at 0.5 psi gas pressure; 60,000 kva, zero power factor leading, at 15 psi gas pressure; 21,000 kva, zero power factor lagging at any gas pressure. Voltage rating: 13,800 volts. The condenser is started from a low-voltage tap on an auto-transformer in the substation.

ELLIOTT

RIDGWAY



For controlling system voltage
Or to increase system stability

ELLIOTT

Outdoor Hydrogen-cooled
SYNCHRONOUS CONDENSERS

Shown at the left is a 50,000 kva unit, located at Alvey Substation, Bonneville Power Administration, Goshen, Oregon. It is one of four identical units which will give B.P.A. improved system stability and voltage control.

This Elliott condenser features an excitation system of unique design, meeting a response ratio of *6.0*, measured in accordance with A.S.A. Standard C42-1941 and enables the condenser to deliver a momentary output of 120,000 kva, zero power factor leading.

There is no pit under this condenser — no expensive cored-out foundation. The unit rests on a simple and economical reinforced-concrete base. Weight and size are reduced by judicious proportioning of stator, rotor and end domes. This means lower cost for the foundation and a saving for the user in cost of maintenance. All controls are engineered by Elliott to make these condensers self-contained units and completely automatic in operation.

The control housing of weatherproof metal-clad design, adjacent to the condenser, encloses voltage regulator equipment, switchboards, gas control panels, and auxiliaries. The housing, of sectionalized construction, can be disassembled and moved to a new location with the condenser, should future load conditions require it.

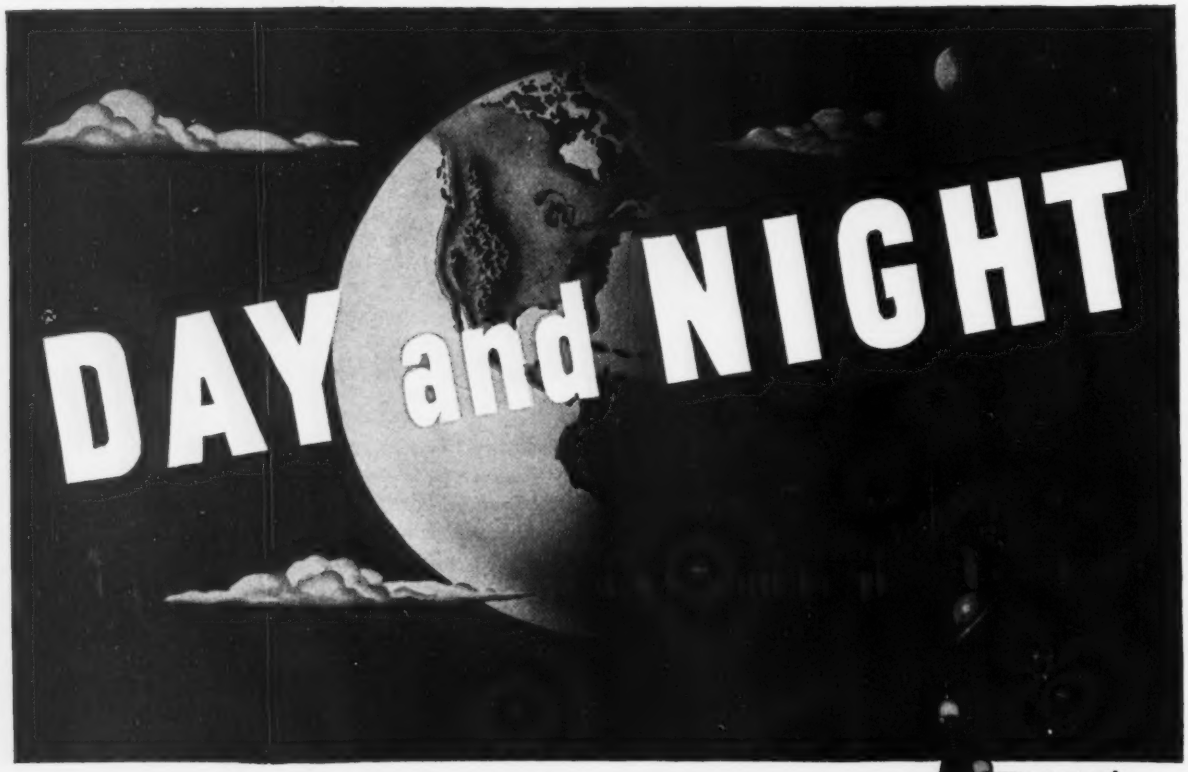
Company

DIVISION

For complete details, consult your nearby Elliott engineer-representative, or write Elliott Company, Ridgway, Pa.

MOLONEY *POWER* TRANSFORMERS

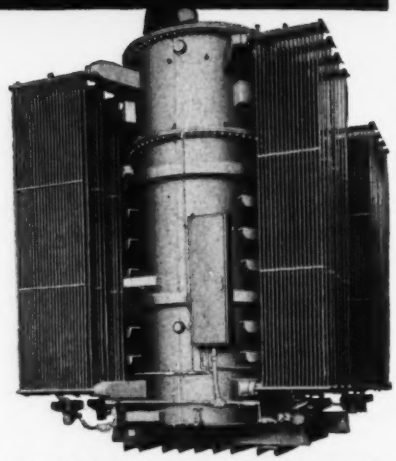
are at work . . .



WHEREVER electricity is transmitted and distributed . . . here in the United States, or in places far remote . . . you will find Moloney Transformers and Regulating Equipment. An ever growing market has been accepting and using our product since 1896. In all this time the name Moloney on a Transformer has come to mean that better performance and greater reliability can be expected of that transformer. We are proud of our reputation and proud of your confidence in us.

Our efforts in engineering, research and design are directed toward the maintenance of this leadership and the result is . . . a better product today . . . an even better product tomorrow.

ME52-1



Illustrated, Moloney Power Transformer rated 35,000/46,667 Kva, 3-phase, 60 cycle 138,000 Grd. Y to 13,200 volts.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers Step Voltage Regulators • Unit Substations

MOLONEY ELECTRIC = { BETTER PERFORMANCE / GREATER RELIABILITY / LESS MAINTENANCE

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

The One Way to Benefit All of the People

The nation's resources are God given and belong to all the people. Therefore, they should be developed by an instrumentality of the people, the government. This long has been the text of the proponents of public power in their diatribes against the development of hydroelectric sites by private companies. It is again being used as an argument against the redevelopment of the Niagara by the five New York companies. It is time that the factors relating to this matter be clearly stated.

There is nothing about the water flowing over Niagara that makes it different from the water that falls on the United States and runs off elsewhere, nor in fact makes it different from the land the water falls on or the minerals under the land. Communists contend that all these things belong to the people to be operated by the government. Others contend only that the government should develop and operate hydroelectric projects.

It would be just as logical to operate the Mohawk Valley as a communal farm by government for all the people as it would be to operate hydroelectric projects. The fact that we have a number of government operated electric enterprises does not make the extension of that method either logical or desirable.

Those who advocate government development and the operation of hydroelectric sites ignore the facts that:

- Business is an instrumentality of the people.
- Business, like government, is a means people have for getting things done.
- There are things people do through government, and some they can get done better through business.
- To protect their interests people have had to surround government with checks and balances and business with regulatory procedures.
- The people have set up regulatory procedures to protect their interests in connection with the activities of the gas company, the telephone company, and the electric company.
- There are more adequate safeguards to the public interest when an electric company builds a project like Niagara than when a government entity builds it, safeguards that are written into statutes, orders, and regulations.
- Regulation by state and federal commissions is the means by which the interests of all people are protected fairly and equally without unjust discrimination.
- Regulation makes certain that a resource like falling water, belonging to the people, can be fully developed by electric companies and the power wisely used without anyone making one cent of profit on the people's resource—for the rate base of the utility company has nothing in it for the value of falling water. The rates under regulation include only the cost of obtaining dollars used to build the electrical equipment and plants that convert falling water to useful kilowatt hours, and the other essential costs of doing business.

Basically, it is only through company development that hydroelectric resources can be fully utilized for the people's benefit. Under electric company development all of the people in the region would receive the benefits. Tax revenues would be produced, revenues that would be available for use by local, state, and federal governments for the benefit of all the people, a claim no one else can make.

This is the answer now and forever against the claim that only a government power project can benefit all of the people.

4,500-Psi Unit, a Triumph in Thinking

Announcement by American Gas & Electric Co that it will install in its Philo Plant a generating unit that will utilize the unprecedented steam pressure and temperature of 4,500 psi and 1,150 F respectively (EW, May 25, p 6) undoubtedly impressed all familiar with the engineering aspects of the industry. But to accept this unusual unit as a great triumph of the physical sciences and to ignore the thinking that made it possible is to miss the significance of this great accomplishment.

This unit did not become a possibility over night. Philip Sporn, AG&E president, stated that it was the consumation of more than 30 years of continuous work and development on the part of his system and of General Electric Co and Babcock & Wilcox Co to bring about more economical methods of power generation.

But even now with this great unit in the blueprint stage the search for a better one will go on. AG&E will make available to the entire industry the knowledge and technical information it has gained. (EW will carry the first technical story in the June 29 issue.) Other companies will try to improve upon the proposed unit. That has been the history of the electric utility industry. The unusual of today becomes the commonplace of tomorrow and the obsolete of the day following. It has been progressive thinking that has made the industry great. And such thinking has made AG&E great.

For this superlative accomplishment in the field of power generation, for its willingness to finance a new development, for its willingness to share with the industry the knowledge which it has acquired with so much difficulty and expense, the American Gas & Electric Co and its president, Philip Sporn, are deserving of the industry's highest praise.

Children Today, Customers Tomorrow

"They (children) should be sold by business, steadily from year to year just as they are educated gradually from year to year."

This quotation from "Where Are You Going to Sell 185 Million Kilowatts?" is not only good advice to the industry but also the theme of the booklet prepared by Reddy Kilowatt Service.

The booklet outlines the Reddy Kilowatt Youth-Parent Plan. There is nothing either new or startling about it. But the idea is so obvious that practically everyone both in and out of the industry overlooks it. Basically the booklet and the plan which it publicizes are built around this simple premise. If the industry is going to have new customers after 1960, these potential customers must be children now. Everybody knows that. But what is the industry doing about it?

Ash Collins, as head of Reddy Kilowatt Service, wants his client companies to sell the children on the industry and on the advantages of Electric Living. As he says, "We must start fresh with these young people but not with just facts. Facts must be tied to emotion. People think, buy, and vote emotionally. Emotions elect people."

Here's his advice to his clients:

1. Aim at youth. Selling youth means selling the oldsters, too. Youth's opinions count with their parents.
2. Show youth the great benefits of your electric service because not only are they "switch-flippers" now, but also because when they become customers in their own right, they will look upon Electric Living as a necessity.
3. Set your sights on 1956, 1960, 1964.
4. Sell hard on the American free enterprise profit system under which your company is able to render the service modern Americans demand.
5. Simplify, dramatize, and humanize your story.
6. Repeat it over and over again.

If this advice is taken, it should not be too hard to sell the output of the 185 million kw of capacity that the industry expects to have on the line in 1964.

Cooperation Follows Competition

Competition is the accepted way of American life. We start competing as babies in contests to prove that we are the most healthy or most beautiful. We never get over the habit, and we carry our competitive tendencies over into our business lives.

Men in the electric utility industry are no exception. Because they work for monopolies, they are denied the pleasure of trying to outdo their fellows on the same field of battle. So instead they enter contests, such as safety or advertising, where achievements become more relative than actual.

A splendid example of this type of competition is the Public Utilities Advertising Association's annual Better Copy Contest. In this contest are entered the best works of nearly 200 advertising managers, mostly those of electric or combination companies. They compete for no costly prize or trophy—just a certificate. But the competition is no less fierce.

But with the passing out of the awards to the winners what happens? The winning entries are published in book form so that the losers may copy and profit by them. That too is the American way—Competition today, cooperation tomorrow. There is no better way.

Here Lies the Root of Industry Progress

Man is too prone to judge the world by his own world, the small minute area in which he works and plays. He assumes that everyone else lives in the same kind of world. Such assumptions can retard the industry which in the past decade has made such phenomenal progress.

But great as that progress has been, it can be duplicated decade after decade if true instead of assumed conditions are considered. This progress will come in the electrification of the American home.

Too often do we hear that everybody has electricity, that every home is crammed with electrical appliances. But neither assertion is true. Not everybody has electricity nor is every home crammed with electrical appliances. Actually not one appliance has 100% saturation in homes already wired. Only the radio has achieved saturation of over 90%. The only appliances with over 60% or better saturation are clocks, irons, refrigerators, toasters, and washers. Many such as blankets, disposers, dishwashers, dryers, and room coolers are found in less than 10%.

Here lies the root of prosperity for the industry. By educating the people and by promoting and selling appliances so that every home is crammed with them, the industry can assure its progress for years to come.

THE ELECTRICAL WEEK

The Issue's News Highlights—Democrats led by Lehman and Roosevelt are reported ready to abandon plan for federal development of Niagara power in favor of development by New York State if they gain assurance public bodies will get preference in purchase of power.

House Appropriations Committee calls for investigation of SMUD-USBR power contract. This same group cuts funds for Army Corps of Engineers multipurpose projects . . . Idaho Power Co files application with FPC for permission to go ahead with Brownlee and Hells Canyon projects on Snake River.

North American Aviation abandoned plans "years ago" to build an atomic propulsion unit for aircraft because shielding problems were too great, Dr Chauncey Starr, director of NAA's Atomic Energy Research Department, announced last week. Using knowledge gained under direct AEC contract, he said, company has instead designed a single-purpose reactor to produce electricity. North American is ready to build an 8,000-kw pilot plant for the government or a commercial power company as soon as the law permits. Cost: about $10 million.

Union Electric and Central Illinois Public Service have agreed that for the duration of the strike at the latter's plants Union will not supply any energy to the struck system but will assume its obligations to supply power to Electric Energy, Inc.

Boston Edison employees plan to meet soon to ratify a tentative labor agreement with management, voting date having been postponed from May 20 . . . North Providence, R. I., decides to install 21 more mercury vapor street lamps this year . . . A second attempt will be made June 2 to raise additional funds to complete new municipal 27,000-kw steam plant at Burlington, Vt.

An 11% Surcharge on bills of Puget Sound P & L will be reduced to 5% with the June-July bills and eliminated entirely Aug. 1 under an order issued by the Washington PSC. The temporary increase was authorized last December to compensate the company for the extra cost of steam generation during a critical water shortage (see page 88 for related story).

Public Utilities are big newspaper advertisers. In 1952 they spent $11,256,000 in that medium, 11.25% over 1951. For the first quarter of this year, the lineage is 26.5% over the same period last year.

Members of Missouri Association of Public Utilities have agreed to disband the 47-year-old organization as the need for the research organization no longer exists, says Missouri P&L's chairman Dan W. Snyder. Most of the member utilities also belong to a broader organization, the Missouri Valley Association.

Commonwealth Edison plans to sell $40 million in bonds and is "giving serious consideration to an application for an increase in rates," Chairman Willis Gale told annual stockholders meeting recently.

Off the Washington Wire—RIF (reduction in force) notices are going out at a fast clip to personnel of federal power agencies. Republicans are getting things in shape for a tight-fisted fiscal year beginning July 1. Reclamation's cut of 1,200 from its 13,000-man payroll may have biggest effect. All bureau public information men have received their pink slips. Regional Office II at San Francisco is being closed which means that Director Richard L. Boke will probably be leaving the service.

A project office will be opened, instead, to administer the Central Valley Project in California. At REA, 36 employees are being "separated" and 74 others transferred from rural electrification to rural telephone loan work. Agency estimates it will reduce the rural electrification work from 840 man-years to 680 man-years.

Abolition of Interior's Water and Power Division means firing 14 employees, but some of these will be rehired by Assistant Secretary Fred G. Aandahl. For the time being no pink slips are being sent to employees of BPA, SPA, and Sepa because funds cuts are less drastic for these agencies. BPA Administrator Paul J. Raver has reportedly been given notice of his dismissal, but the date hasn't been set.

FPC accepts Interior Secretary McKay's request to withdraw as an intervenor in the Oxbow project hearing. In other actions, FPC decides to review the examiner's decision ordering issuance of a federal license to Namekagon Hydro Co for construction of hydro project on Namekagon River in Wisconsin. FPC also suspends a proposed rate increase involving Delaware P&L and two of its subsidiaries.

In Case Congress should cut off new funds, Portland GE's Vice Pres Ralph Millsap says his engineers are studying what the company may have to contribute toward completing the Dallas Dam and powerhouse on the Columbia River . . . Duke Power begins construction on $6 million 77-mile, 230-kv transmission line running from its Riverbend generating plant near Charlotte, N. C., to Duncan, S. C. Company officials expect the line to be operating by the end of 1953.

Congratulations—Dallas P&L elects C. A. Tatum, Jr. president succeeding W. G. Moore who becomes chairman. Moore succeeds G. L. MacGregor who is made president of Texas Utilities Co. MacGregor succeeds H. L. Aller who is made chairman . . . Minnesota P&L names Clay C. Boswell executive vice president and F. S. Rice and J. L. McEachin vice presidents. Avery R. Schiller, Public Service of New Hampshire president, is named an AIEE fellow at Manchester.

General Electric elects Donald L. Millham vice president . . . J. G. White Engineering Corp elects Robert H. Barclay, manager of engineering department, to the post of vice president of engineering, and H. P. Jackson, manager of construction department, vice president of construction . . . Mississippi P&L names R. W. Barswell vice president.

NIAGARA FALLS with its power potential of 1.1 million kw is subject of a three-way fight but this may narrow to a two-way dispute

Will Public Power Unite on Niagara?

Lehman and Roosevelt, backers of federal plan, reported ready to swing behind New York's proposal to build project

Bipartisan coalition of New York officials was shaping up last week to battle the development of additional electric power at Niagara Falls by electric companies.

Democrats headed by Sen Herbert H. Lehman and Rep Franklin D. Roosevelt were reported ready to swing behind Republican Gov Thomas E. Dewey to wrest the power development from the five leading electric companies in the state.

Stake . . . At stake is the development of an additional 1.1 million kw of electric power on the U. S. side of Niagara Falls. The five private companies headed by Niagara Mohawk Power Corp earlier this month asked Congressional approval of their plan.

Up until now the public power advocates have been divided. The Democrats favored federal development of the additional power made available under a 1950 treaty with Canada. Governor Dewey and the Republicans have favored state development by the Power Authority of the State of New York.

Bill which would provide for state development of the additional Niagara power was introduced last week in both houses of Congress after hearings were held on bills providing for private and federal development. Republican Sen Irving Ives introduced the bill in the Senate at the request of the power authority. Rep Frank J. Becker introduced the House bill.

Stumbling Block . . . Bone of contention between the public power advocates comes over sale of power. Democrats favor the federal preference clause which gives priority in purchase of power to public bodies and cooperatives. New York State law, written by the Republicans, gives preference merely to "rural and domestic consumers."

Democrats Lehman and Roosevelt are talking as if they would accept the Republican position if they can gain some assurance that the state would administer the state preference clause to favor public bodies.

Two attempts to bring Dewey, Lehman, and Roosevelt together for a face-to-face meeting on the matter failed, but the Democrats reported in Washington early last week they were still hopeful that such a meeting would soon take place.

If the public development advocates can get together, they would appear to have a much better chance of gaining their end. But Congress will have the final say.

While Dewey and the two New York Democrats exchanged telegrams

regarding a parley, Congressional committees decided to mark time on the pending private and federal bills for Niagara development. House and Senate Public Works Committees held joint hearings on these bills earlier this month (EW, May 25, p 7).

A move by House Committee Chairman George A. Dondero, Michigan Republican, to gain committee approval of the company bill failed. Committee member Tom Steed, Oklahoma Democrat, asked for President Eisenhower's views on the bills.

House Group Asks Probe of USBR-SMUD Contract

House Appropriations Committee has called for an investigation of Bureau of Reclamation contract to sell 290,000 kw of power to Sacramento Municipal Utility District. Signed last December (EW, Dec. 29, 1952, p 79), the 40-year contract is scheduled to go into effect July 1, 1954.

In a report which accompanied the Interior Department Appropriations bill to the House, the committee urged Secretary of Interior to suspend further action under the contract until the investigation is completed. Similar action by Senate Appropriations Committee would jeopardize the contract.

Bureau critics have charged that rates provided in the contract are too low to repay the government's investment in the power facilities.

The House committee said it wanted to know the effect of the contract, its legality, and a full review of it by the comptroller general, who is money watchdog for Congress.

While this report has no binding effect on the Secretary, it would be heeded if Senate unit concurred.

SMUD officials, anxious to keep the Senate group from following the lead of the House unit, testified that the contract is a valid one and the federal investment could be paid off in 50 years. In House testimony, Pacific Gas & Electric Co, now serving SMUD, declared USBR would save $65 million in wheeling charges by selling to the company. SMUD attempted to rebut this testimony before the Senate group by stating a major portion of the wheeling cost could be saved by serving SMUD directly from high voltage trunk lines running through the center of the district if stepdown facilities were built.

House Passes Appropriations Bill for Army Multipurpose Projects

House of Representatives, following recommendations of the Appropriations Committee, last week whacked a second slice off the 1954 money request for Army civil functions including multipurpose projects. Coming after the Administration's big cut, the two slashes together left less than $400 million standing of the $660 million set up for rivers and harbors and flood control in Truman's January budget—a drop of nearly 40%. No funds were provided for start on new projects proposed by ex-President Truman.

Of the multipurpose projects, the House struck out funds for seven requested by the Administration, recommended lesser amounts for 11 and left the Administration figures intact for six. Following is a comparison of amounts voted by the House for multipurpose projects and proposed figures submitted in Truman and Eisenhower budgets:

Project	Truman Budget	Eisenhower Budget	Voted by House
	(Millions of dollars)		
Arkansas:			
Blakely Mountain	6.0	5.5	0.0
Bull Shoals	2.0	2.0	0.0
California: Folsom	14.8	9.8	9.8
Florida: Jim Woodruff	10.4	7.9	7.0
Georgia:			
Buford	9.1	8.5	5.0
Clark Hill	2.3	2.3	2.3
Idaho: Albeni Falls	7.7	7.2	6.0
Michigan:			
St. Marys Power Plant	.2	0.0	0.0
Missouri: Table Rock	10.8	0.0	0.0
Nebraska: Gavins Point	17.8	12.1	10.0
North Carolina: Kerr Dam	1.5	1.5	1.5
North Dakota: Garrison	39.0	31.0	27.0
Oklahoma: Tenkiller Ferry	.3	.2	.2
Oregon:			
Detroit Reservior	1.3	0.0	0.0
McNary Lock and Dam	28.2	27.7	25.0
Lookout Point	20.3	20.0	18.0
The Dalles	58.4	37.4	29.3
South Dakota:			
Fort Randall	22.7	14.7	11.0
Oahe Reservoir	14.8	8.3	8.3
Tennessee:			
Cheatham Lock and Dam	5.8	4.8	3.0
Old Hickory	18.0	12.6	12.6
Texas:			
Dam B of Neches-Angelina River	.7	0.0	0.0
Washington:			
Chief Joseph	30.0	25.0	23.0
Ice Harbor	4.9	0.0	0.0
Total Multipurpose Projects	327.0	238.4	189.0

MEETING REPORT

Promotion of Power Sales . . .

. . . discussed at conference sponsored by Edison Electric Institute and Southeastern Electric Exchange

The greatest thing that electric utilities can offer the public is dependable service, according to Arthur M. Williams, South Carolina Electric & Gas Co, and W. Paul Lyman, Carolina Power & Light Co. They spoke at a Power Sales Conference held May 21-22 in Charleston, S. C.

The conference, sponsored jointly by the Edison Electric Institute Industrial Power and Heating Section and the Southeastern Electric Exchange Industrial Power Committee, was attended by almost 100 utility power sales engineers.

Williams said that only if utilities continue to give their customers and prospective customers prompt, courteous, efficient and dependable service can they hope to stay in business.

New Applications . . . American industry is planning large future capital expenditures for plant and equipment regardless of the extent of any possible armament cutbacks, according to recent surveys, said J. H. Coates, Ebasco Services, Inc. Coates described some new industrial applications including: Cold treating of tools, immense forging and extrusion presses, catalytic heat recovery, chemical and reverse cycle plating, sonic energy, multiple cycle motors, ionic demineralization of water, electro luminescent lighting surfaces, and electric printing.

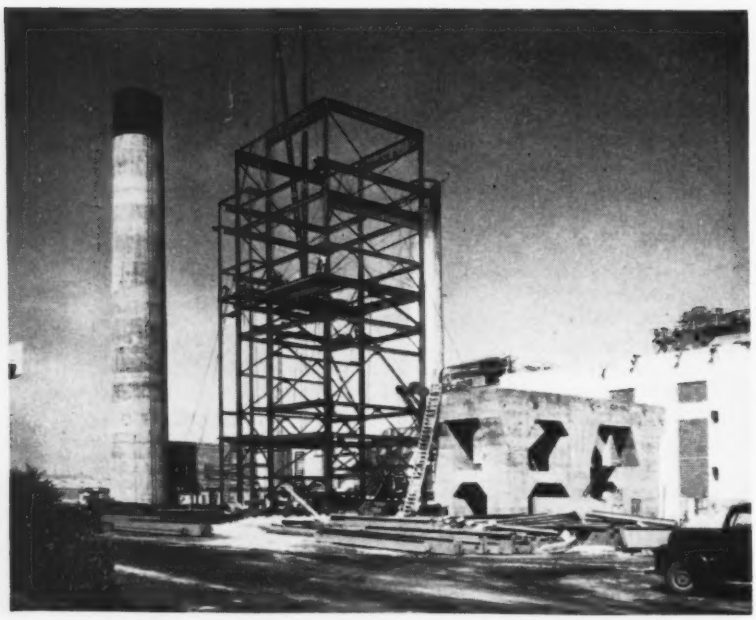
At the present time about 59% of industrial plants have cafeterias or some form of in-plant feeding—leaving 41% yet to be sold—not counting the constant crop of new installations in the planning or construction stage, according to Walter Sormane, Hotpoint, Inc.

Of existing plant cafeterias, worker patronage has been surveyed at less than 60%, he said. A campaign to sell modern electric kitchens should yield an appreciable load, Sormane commented.

Factors in Plant Location . . . According to C. M. Wallace, Jr, Georgia Power Co, some of the things an industry looks for in seeking a town for a plant location are: Clean and tidy appearance, an aggressive spirit, a good education system, a good recreation and amusement program, churches, good shopping centers, a progressive city government, and good living conditions.

D. L. Beeman, General Electric Co, said that a typical five-story office building with a complete 480 Y/277-v system will cost about $90 per kva, whereas a 208 Y/120-v system for the same building would cost about $120 per kva. Beeman said that a large aircraft hangar installation on the West Coast, originally designed for a 208 Y/120-v lighting system and a separate 440-v power system, saved about $15,000 by changing to a 480 Y/277-v combined system. Paul Lyman, Carolina Power & Light, commented that utility company distribution engineers "resisted" the supplying of a 480-v system to any plant. Beeman suggested that dry type grounding transformers could be installed by the customer at relatively low cost to establish a neutral in the 480-v delta system to permit the use of high voltage lighting.

West Penn Power Co's experiences in "mass selling" by holding 13 electric heating meetings with groups of customers were outlined by George E. Duerr. He said that such mass selling taught his company that it must "take the show to its customers —not ask them to come to us;" give them lots of "how to" stories; take the mystery out of electric heat and show that it is easier to apply than fuels. Duerr said that mass selling methods help keep sales costs low enough to make this new business highly profitable by shortening the time required to make a sale. He advised the use of low cost metal sheath heaters to prove the advantages of electric heat and thus make customers more agreeable to sales arguments when larger heating jobs are tackled.



Pedestal for a Power Unit

Pedestal has been erected for new 80,000-kw turbine-generator being installed at Florida Power & Light Co's West Palm Beach Riviera Station. The steel framework will house outside boiler installation.

FPC Permits . . .

. . . sought by Idaho Power Co for Brownlee and Hells Canyon projects on Snake River

Idaho Power Co is ready to undertake its proposed three-dam development of the Snake River in the 100-mile stretch of the Snake downstream from Weiser, Idaho.

The company last week filed applications with Federal Power Commission for two of the dams and powerplants. Earlier it had filed an application for its Oxbow project and hearings are to resume July 7 on that application.

Controversial Site . . . Site of this proposed development has long been the center of a controversy between federal and company spokesman, but this cooled recently when the new Republican Administration withdrew its opposition to the company application (EW, May 11, p 6). Former Democratic Administrations had fought for the site to be used for the controversial Hells Canyon project.

Interior said it would no longer oppose the development ". . . if the plan proposed by the Idaho Power Co is reasonably comparable as to results . . ."

This is believed to have spurred the company to offer to build the full three-dam development rather than one of the dams at a time.

The company first announced its three-dam development plan last December (EW, Dec. 8, p 8), but had applied for a federal license for only one of these—the Oxbow—until last week.

Total estimated cost of the full company development plan is $134,319,600 and total installed capacity in the three powerplants is 772,400 kw. This compares with a cost of approximately $360 million and an installed capacity of some 900,000 kw for the Hells Canyon project planned by the Bureau of Reclamation.

Plans Revised . . . Applications for the two new projects differs slightly from earlier plans released for these projects. The Brownlee project proposed by the company has an installed capacity of 360,400 kw. This dam would have a maximum height of 395 ft, and would be about 1,700 ft long including the spillway. Reservoir would extend 57½ miles upstream from the dam, with a top area estimated at 13,300 acres. The Hells Canyon project proposed by the company would have an installed capacity of 272,000 kw. This dam would be about 320 ft high and 1,100 ft long including the spillway. Oxbow would have an installed capacity of 140,000 kw.

Club Warned of Dangers of Government Authorities

Government administrational authorities can be dangerous, Bayard L. England, president, Edison Electric Institute, told the third joint meeting of the Interstate Power Club and Power Engineers Association, which met recently at New Haven, Conn. In his paper, presented in his absence, England said that there is a danger of "empire building" in some authorities that can be controlled only by their administrators.

Because of their contacts and interest in customers' welfare, power salesmen should sparkplug "industrial seeing" programs, Paul H. Hildebrand, director of lighting, Pennsylvania Power & Light Co, declared. Utility management, he said, should be interested in starting visual programs because they will help business, their customers, and the public in general.

Healthy utility business depends on stable, diversified industries. This was told to the salesmen by Sherman Knapp, president, Connecticut Light & Power Co, in a paper presented by R. P. Lee. Fostering a favorable "industrial climate" gives utilities an opportunity to sell themselves to the public. One way to entice diversified new business to a service area, Knapp continued, is through amended state legislation that will liberalize the conditions under which investing firms and insurance companies may finance industries.

Other items in the week's news will be found starting on page 155.

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING MARCH

State	Utility	Plant	Fuel	Capacity (kw)
N. J.	Public Service Electric & Gas Co	Kearny B	S	145,000
Ill.	Rantoul Water & Light Plant	Rantoul	IC	1,233
Mich.	Northern Michigan Electric Cooperative	Advance	S	15,000
Minn.	Marshall Municipal Utilities	Marshall	S	3,000
N. D.	Central Power Electric Cooperative	Wm. J. Neal	S	30,000
Kan.	Kingman Light & Power Department	Kingman	IC	1,000
Md.	Eastern Shore Public Service Co	St. Michaels	IC	500
Va.	Corps of Engineers	J. H. Kerr	H	32,000
Tenn.	Tennessee Valley Authority	Boone Dam	H	25,000
Ark.	Piggott Public Improvement District	Piggott	IC	675
La.	Alexandria Power & Light Department	Alexandria	S	7,500
Okla.	Oklahoma Gas & Electric Co	Arbuckle	S	66,000
Tex.	Weatherford Water & Electric Department	Weatherford	IC	2,720
Tex.	Garland Electric Department	Garland	IC	2,100
Wash.	Public Utility District No. 1 Chelan County	Rock Island	H	22,500

PLANT RETIREMENTS DURING MARCH

N. Y.	Rochester Gas & Electric Corp	Rochester 4	H	800
Ill.	Oquawka Light & Water Department	Oquawka	IC	200
Mich.	Consumers Power Co	Rugg	H	160
Wis.	Wisconsin Power & Light Co	Riverside	S	6,000
Minn.	Otter Tail Power Co	Bemidji	S	2,500
S. D.	Sioux Falls Electric Lighting Department	Sioux Falls	IC	360
S. D.	Otter Tail Power Co	Lake Preston	IC	500
W. Va.	Monongahela Power Co	Spencer	S	50
W. Va.	Monongahela Power Co	Glenville	IC	200
Ark.	Piggott Public Improvement District	Piggott	IC	72
Ariz.	Salt River Project Agricultural Improvement & Power District	Tempe Diesel	IC	10,000
Utah	Garkane Power Association	Hatch	IC	456

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of April 1—Hydro, 20,714,040 kw; Internal Combustion, 2,110,526 kw; Steam, 60,325,149 kw; Total 83,149,715 kw.

ATOMIC INDUSTRIAL FORUM announces at first press conference that it aims to foster commercial development of nuclear energy

An embryo industry waits to be born . . .

The New AEC Plan: Keep the

This month in Washington hearings will begin that may well lead to the birth of a commercial atomic energy industry in this country.

The Joint Committee on Atomic Energy is set to hear pros and cons of a proposal by Atomic Energy Commission that Congress liberalize the Atomic Energy (McMahon) Act of 1946 to permit private development of nuclear power reactors.

Four industry teams are now into the second year of studies to determine whether nuclear power plants are commercially feasible. A fifth recently entered the field. Initial reports of the four original teams to AEC, under whose auspices the studies have been made, are cautiously optimistic.*

But even the most eager advocates of atomic power do not forecast that the move toward nuclear plants will snowball. Aside from technological and economic difficulties, there is the big problem of government control.

AEC Proposes Law Changes

Prodded by the Joint Atomic Energy Committee headed by Rep W. Sterling Cole of New York, Gordon Dean and the AEC on April 7 came up with a proposal that Congress end the commission's absolute monopoly on possession and development of fissionable materials for production of atomic energy. Backed by President Eisenhower, the proposal will be laid before the Joint Committee when it gets to work on changes in the act about June 15.

Business men feel that, in order to make a private atomic industry both practical and profitable, these changes are needed:

- Congress must permit private ownership of both reactors and materials for fuel.
- The Atomic Energy Act must give assurance of steady fuel supply for private plants.
- Some provision should be made for orthodox patents in the law. AEC has heretofore insisted on keeping control over all patents and inventions. This for two reasons: The cost of work in most cases has been carried on by the government, and many inventions are based on information developed at government expense. But with private research coming up with its own innovations, business men feel some protection is necessary.
- Secrecy procedure should be eased to permit freer flow of information and consequently faster development of the art. This can be done, business people believe, without damage to the nation's security.

Changes in the act are expected this year, after the Joint Committee hearings are ended. But changes will not come without a fight. Already the Congress of Industrial Organizations has protested what it termed "the announced program of turning atomic energy development over to the big monopolistic corporations." In a letter to Chairman Dean, O. A. Knight, chairman of the CIO committee

*Electrical World is publishing these reports in serial form, beginning with of Commonwealth Edison Co-Public Service Co of Northern Illinois, which will be found on Page 68. Other industry teams which have submitted reports are: Detroit Edison Co-Dow Chemical Co; Union Electric Co of Missouri-Monsanto Chemical Co; and Pacific Gas & Electric Co-Bechtel Corp. A fifth team, Foster Wheeler-Corp-Pioneer Service Engineering Co, is still in the first stage of its study and has not yet submitted a detailed report to AEC.

CHAIRMAN DEAN handed AEC proposal to change law to . . .

CHAIRMAN COLE of Joint Committee on Atomic Energy

. . . as the government begins to consider

Bomb, Release the Atom

on regional development and conservation, advanced several arguments against private development:

- Allowing some companies to operate atomic facilities gives them technical advantages and federal aid not available to other companies. It "makes a joke out of our much ballyhooed policies of secrecy."
- "Control by the big monopolies may well mean frustration and limitation of peace-time development, for such is the usual history of private monopoly situations."
- "Immense government subsidies, direct or indirect," would be required.

Utility Workers Union of America, CIO, which for the last five years has opposed expansion of federal power, nevertheless generally followed the lead of its parent union last month in regard to control of atomic energy. In an officers' report made to its Sixth Convention in Detroit, the union stated:

"We believe that if and when it is practicable to use atomic energy for the production of electricity, the government should make it available to the industry at a cost that would help repay the billions of dollars that have been spent in its development.

"We do not believe the government should relinquish the ownership of its valuable atomic energy resources to the utilities or any other industry."

On the AFL side of the fence, International Brotherhood of Electrical Workers has not yet taken a stand. A spokesman said the matter was being considered.

Even if the act is changed to make possible full participation by private firms, the United States stands to lose the race for the first commercial atomic energy plant to Britain. The British Minister of Supply has announced the country intends to begin construction shortly on a dual-purpose breeder reactor plant across the River Calder from Sellafield, where Britain makes its plutonium. The British hope to put the plant on the line by 1958, to supply the power needs of Cumberland, Westmorland and part of Lancashire.

How U. S. Plans Developed

Industry interest in the use of atomic energy was slow in developing after the bomb was dropped. When the Atomic Energy Act was passed in 1946, business interests took a quick look at the possibility of central station power from the atom and went away discouraged. Security regulations were strict, and the technological problems had hardly been touched. But as time went on, AEC had some trouble with reactors, of importance then primarily as a source of plutonium for atomic bombs. The huge Hanford plutonium plant, worked at capacity during the latter part of the war, had come close to shutting down. The Commission beat about to find a way to get more and better reactors to produce more plutonium. Early in 1949 it created a Division of Reactor Development and named physicist Lawrence R. Hafstad as its head. His first job was to find scientists and engineers who could contribute to reactor improvement.

While this was going on, General Electric Co, contract operator at Hanford, rehabilitated the plant, and plutonium production took an upswing. By 1950 the commission stopped worrying about it.

AEC's HAFSTAD: He pushes development of "power plus plutonium" reactors

DETROIT EDISON's CISLER: He heads the first atomic industry association

MIDDLE SOUTH's DIXON: He manages EEI's Committee on Atomic Power

But by this time Hafstad had come up with the idea that reawakened utility interest in the atom. That was: Build a reactor that would produce both plutonium and power. At Hanford, waste heat was "dumped" into the Columbia River. Why not design a reactor to operate at higher temperatures than the low-heat Hanford units, install a heat exchanger, and carry steam to a conventional turbogenerator?

Almost immediately Charles A. Thomas, president of Monsanto Chemical Co and a veteran of the atomic energy program, came to AEC with a formal offer based on Hafstad's idea:

Let Monsanto and Union Electric Co take a look at everything known about reactors, then see if they could design a practical dual-purpose reactor that would produce plutonium for the military and supply power needed for Monsanto's chemical operations.

Four Teams, Later Five

The commission agreed; in fact it went further, and let a total of four industry teams into its laboratories to see what they could do with the problem. And now there are more firms interested in commercial possibilities than you could aim an atom at.

On the utility side, Walker Cisler, president of Detroit Edison Co, has been a leader in development of atomic power. He has pressed hard to put the Dow Chemical Co-Detroit Edison group into the lead and be first on the line in this country with a commercial atomic power plant. The Dow-Detroit plan has an inside track with members of AEC, because it alone shows promise of proceeding without substantial assistance from the government.

Late last year Cisler picked up a suggestion from Dr T. Keith Glennan, president of Case Institute of Technology and a former AEC member, that an atomic industry association be formed. Feeling such an association was necessary to help bring the industry to maturity, he set to work setting one up. Three weeks ago Cisler was named president of Atomic Industrial Forum, Inc, by a board composed of presidents and atomic energy executives of 13 corporations and educational institutions.

At a press conference in New York announcing the forum's establishment, Adm Earle W. Mills, president of Foster-Wheeler Corp and an AIF director, pointed out that atomic energy had started out as a concept for power and was diverted to weapons. "Now it's coming back to power," he said.

Another industry group has been formed to look into atomic energy from the utilities' point of view. This is Edison Electric Institute's Committee on Atomic Power, of which Edgar Dixon, president of Middle South Utilities, was recently named chairman. A spokesman for the committee said no definite policy of operation had as yet been approved, beyond the stated aim of the group: To assure government bodies full cooperation of the industry if any was possible.

In interviewing members of the industry teams, Electrical World editors found one, Dow-Detroit, willing to say: When the Atomic Energy Law is changed and when we are satisfied our design is economic, we plan to start construction of a commercial atomic energy power plant without outright subsidy or plutonium market guarantee from the government.

With Dow-Detroit since the beginning has been Nuclear Development Associates, an atomic research organization at White Plains, N. Y. NDA has been doing a good bit of the group's reactor research and design work. Object, says William Loeb, of NDA's Detroit-Dow section, is to design a reactor that will produce economical electricity.

Power Plus Plutonium

As his group sees it, this reactor would be a "breeder", that is, one producing more fissionable material than is supplied. Its purpose would be dual—producing power plus plutonium for sale to the government and on the open market, if law changes permit. This would keep the project from being totally dependent on a military market for plutonium.

Dow-Detroit believes that this way it can avoid asking for a direct government subsidy, as a couple of the other industry teams have done. One thing the team would ask: That the government continue to make available AEC's nuclear research laboratories during the development part of the program, since AEC alone has such facilities.

Their scheme is to build the reactor side first. When the reactor has proved itself satisfactory for a year or so, the electrical end of the plant would be installed. The whole would be designed so that if the first reactor

doesn't perform properly the group can install a second without too much change. Two or three reactor designs will be carried along at the same time. The group considers it very likely that at least one other reactor, incorporating changes developed out of actual operation of the first, eventually will be installed.

Although the team hopes eventually to build its nuclear plants near load centers, it is assumed that an exclusion area will have to be provided for the first. A possibility being considered is that the initial reactor will be built on a ship or barge, then floated to a location (probably in the Great Lakes near Detroit Edison's system) which would provide adequate exclusion area. There it would be anchored or sunk and development work begun toward a commercial plant.

"We have to shoot for the long-run plant" Loeb commented. "We're trying to decide what the long-range capability of our nuclear power plant should be. If our first design is not about 80% of the ultimate, it won't be built, because someone would soon have a more efficient one on the market."

The financial approach was underlined by Alton P. Donnell of Detroit Edison, coordinator of the entire project.

"The whole purpose of our study and design work is to determine whether a nuclear power plant is economically feasible," he said. "And we won't know that until the plant is going."

The Teams Report

As with Dow-Detroit, Electrical World asked the three other industry teams with power company members for a report on progress since they submitted their first reports to AEC. These were the replies:

• Commonwealth Edison-Public Service of Northern Illinois: The team is continuing to study nuclear power

(For the first of four feasability reports to be published in EW, turn the page)

in an effort to improve economics in the hope it can bring cost more in line with cost of conventional fuel. It has submitted a third reactor design to AEC, which will not be declassified with others submitted earlier (See report beginning on Page 68).

• Union Electric Co-Monsanto: Plans are progressing to produce an extensive mock-up or pilot plant preliminary to construction of a full-scale plant. A recent cost survey for a power-only reactor of 100,000-200,000-kw capacity (the group expects to develop a dual-purpose reactor first) shows that electricity can probably be produced at between 7.23 and 11.14 mills/kwhr, or 3 to 5 mills less than was anticipated in the group's first report to AEC.

• Pacific Gas & Electric-Bechtel Corp: Nothing can be released beyond the report filed with AEC.

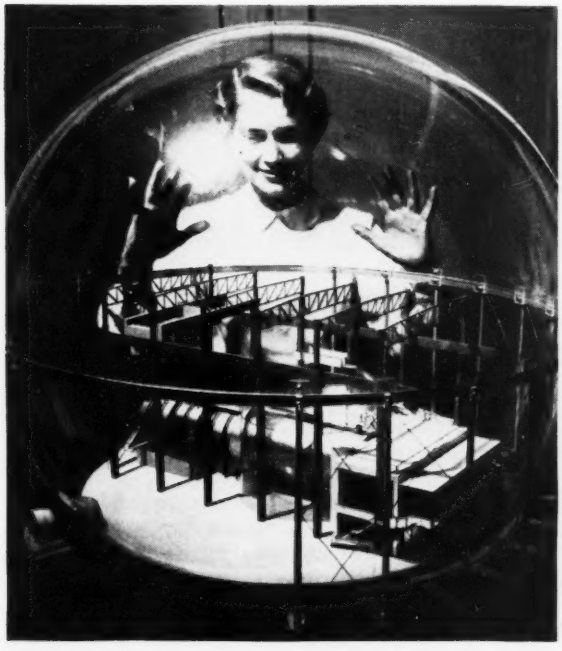
Foster Wheeler-Pioneer Service, which is still in the first stage of its study, had this to say about its progress:

"Since this team is composed of utility engineers and manufacturers whose primary interest is to aid in establishing a stable power economy, the major effort is being directed toward development of a nuclear power plant that emphasizes the power-only design and is not dependent upon the unstable market for weapon materials."

While the utilities have been developing an atomic energy program, two important suppliers of their electrical equipment—Westinghouse Electric Corp and General Electric Co—have also been active in the field.

Westinghouse got in first, primarily because of its AEC contract to build a reactor that would power the

(*Continued on page* 154)



GENERAL ELECTRIC is putting an all-metal safety sphere around the submarine reactor it is building near Schenectady. Unit will power the USS Sea Wolf. Above, a model peers into the model

WESTINGHOUSE starts atomic equipment plant near Pittsburgh, Pa. Left to right, William C. Miller, plant manager; Charles Weaver, head of Atomic Power Division, and contractor look on

Is Atomic Power Generation Feasible?

Commonwealth Edison-Public Service Co study team examines . . .

Introducing a Series on Atomic Power Generation

Under wraps ever since the programs were initiated, the studies of nuclear power generation carried on by pairs of utilities and industrial or consulting firms have now been released by the Atomic Energy Commission.

The four groups, it now develops, have taken different approaches to the utilization of atomic fuel. As a consequence comparisons can now be made of the probable performance and economies of the several methods.

These methods are as follows:

Commonwealth Edison Co and Public Service Co (CEPS)

1. Helium-cooled, graphite-moderated reactor, 45 Mw
2. Reactor cooled and moderated by heavy water, 211.5 Mw

Pacific Gas and Electric and Bechtel Corp

1. Water-cooled thermal reactor
2. Liquid sodium-cooled fast reactor

Union Electric Co of Mo and Monsanto Chemical Co

1. Sodium-cooled graphite-moderated reactor

Detroit Edison and Dow Chemical Co

1. Liquid metal cooled fast breeder reactor to provide high coolant temperature (950-1,100 F) for efficient power recovery

Each will be treated in a series of articles beginning in this issue of Electrical World. At the conclusion of the series a tabulation will be presented to reveal respective characteristics in contrasting comparison.

. . . Gas-cooled and heavy-water cooled reactors. Finds both feasible but analysis shows heavy-water reactor to be economically more attractive for power generation purposes. Many problems remain unsolved

Initial feasibility studies of the Commonwealth Edison-Public Service Co (CEPS) team were focused on two types of reactors for power generation;

1. A helium-cooled, graphite-moderated reactor.

2. A heavy-water (D_2O) moderated and heavy-water-cooled reactor.

Three primary design objectives were applied to each type of reactor. These were (1) production of plutonium and electric power, (2) use of natural-ruanium fuel, and (3) maximum utilization of proved reactor technology.

The gas-cooled, graphite-moderated reactor was chosen for the first intensive study because it could provide a substantial beginning in atomic power with a minimum interference with reactors now under construction or contemplated.

On the basis of the investigation by the CEPS group it is felt, however, that the heavy-water (D_2O) reactor concept has the best economic possibilities of the two studied, even though there are important uncertainties as to the availability and cost of heavy-water and the practicality and cost of chemical processing of the fuel-elements.

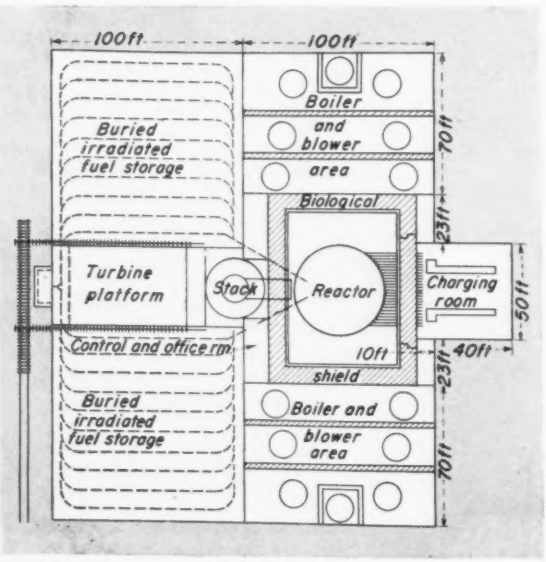


Fig. 1. PLANT LAYOUT for generating station using a gas-cooled reactor. Cost is $890 per kw for net output of 45 Mw

Helium-cooled and Graphite-moderated Reactor

The following features are incorporated in the design of the helium-cooled, graphite-moderated reactor and power plant (Fig. 1):

1. A 350 Mw (heat) power level reactor, natural uranium loading.

2. A reactor composed of a cylindrically-shaped core containing fuel elements in graphite (985 tons of graphite) and a graphite (498 tons) reflector, all in a spherical steel pressure vessel. The fuel elements are cooled by helium circulating in two directions from a center slot.

3. An annual natural uranium fuel requirement approximating the initial charge of the reactor.

4. Helium coolant at 150 psia pressure, entering the reactor at 400 F and leaving at 700 F. The 3,200,000 lbs of helium per hr is circulated by six electrically driven (2,500-hp) motors and six turbine-driven (2,800-hp) 75,000-cfm axial-flow blowers.

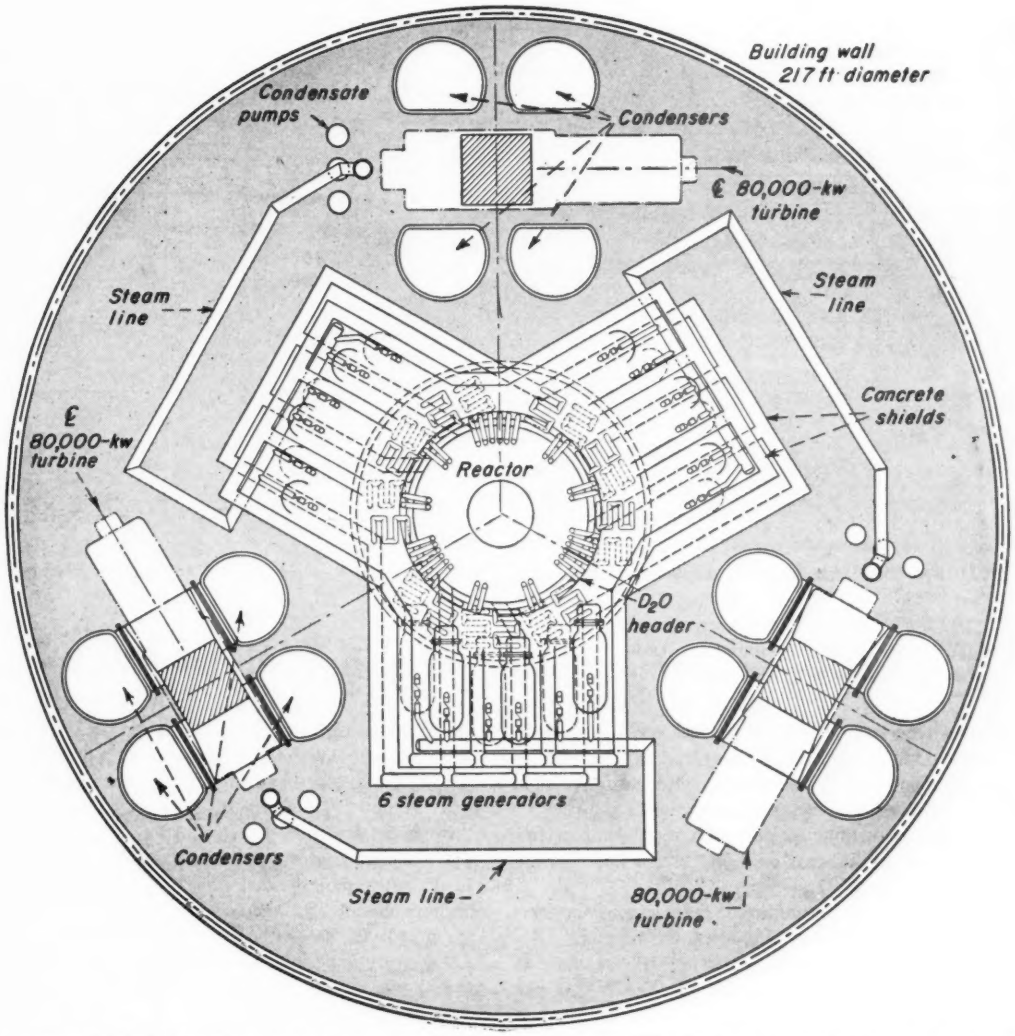


Fig. 2. LIQUID-COOLED REACTOR PLANT layout provides for symmetrical arrangement of three 80,000 kw turbo-generators and 18 steam generators each rated 180,000 lb of steam per hr. Equipment is housed in a sphere and grouped around a centrally-located reactor

5. Straight-through type boilers (12 in number), each rated 90,600 lb per hr.

6. A gross electric power output of 61,700 kw (60,000 kw name-plate rating). Auxiliary power is approximately 27,000 kw of steam and electrically driven equipment. A net 45,000 kw of electricity is available to the transmission system.

7. A turbogenerator, steam operated at 265 psia and 525 F, producing 61,700 kw with 2½-in. exhaust pressure or 67,300 kw with 1 in. exhaust pressure. A condenser of 103,000 sq ft provides exhaust pressure of 1 in. with cooling water at 60 F.

8. Underground tanks, for 3 million cu ft of helium at 500 psia, complete with continuously operating purification system.

9. Construction costs, estimated to be $40 million or $890 per (electricity) kw net at 2½-in. Hg.

It is the opinion of the CEPS group that both helium-cooled and heavy water reactor designs are feasible from engineering and operating standpoints. However, because of better economic possibilities of the heavy-water-cooled and moderated reactor this article will confine itself to details of the latter reactor.

Reactor Cooled and Moderated by Heavy-water

The heavy-water-cooled, heavy-water-moderated reactor and associated power plant has these design features:

1. A 1,064-Mw (heat) power level reactor, natural uranium loading.

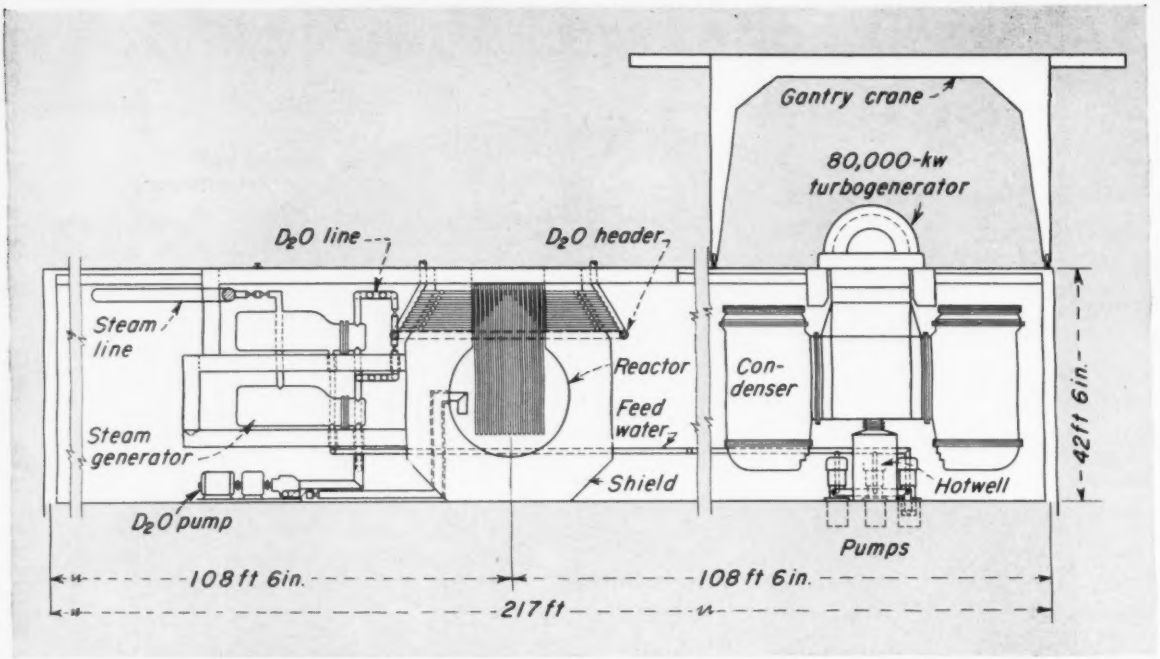


Fig. 3. SECTIONAL VIEW of liquid-cooled reactor plant, shown also in plan view in Fig. 2. Note two-level arrangement of steam generators

240,000-kw atomic power plant using heavy water seen

2. A reactor core, cylindrically shaped, having uranium fuel in tubes, D_2O moderator, coolant and reflector along with suitable control-rod assemblies. The entire core is enclosed in a spherical steel pressure vessel.

3. A helium-blanketing purging system in the pressure vessel just outside the reactor core and above D_2O storage tanks.

4. An annual natural uranium fuel requirement approximating eight times the initial charge of the reactor.

5. D_2O coolant at 800 psia, entering the reactor at 388 F and leaving at 440 F. The 64,500,000 lb D_2O per hr is circulated by six electrically driven (2,000-hp motors) and three turbine-driven (2,300-hp), 15,300-gal-per-min centrifugal pumps.

6. Steam generators (18 in number), each rated 180,000 lb per hr.

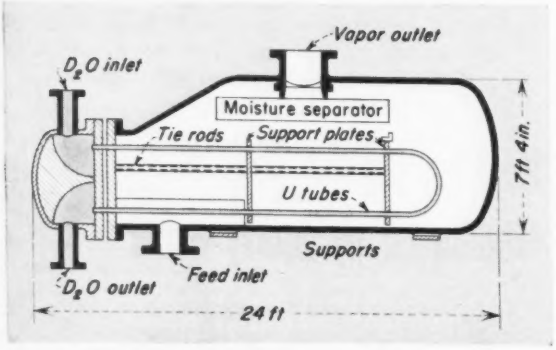


Fig. 4. STEAM GENERATOR for use with liquid-cooled reactor delivers steam at 180 psia. Each is rated 180,000 lb per hr.

7. A gross electric power output of 225,500 kw (240,000 kw nameplate rating). Auxiliary power is approximately 20,500 kw of steam and electrically driven equipment. A net 211,500 kw of electricity is available to the transmission system.

8. Turbogenerators, steam operated, at 175 psia and 371 F (saturated) divided among three units. Each generator produces 75,200 kw with 2½-in. Hg exhaust pressure or 82,000 kw with 1-in. Hg exhaust pressure. Four 35,000-sq ft condensers on each turbogenerator provide exhaust pressure of 1 in. Hg, with cooling water at 60 F.

9. Underground tanks for 2,000 cu ft of helium and 62,000 gal D_2O.

10. Construction costs, estimated to be $118 million of $558 per (electricity) kw net at 2½ in. Hg exhaust pressure.

The material that follows elaborates upon the more important design features of the heavy-water-cooled and moderated reactor and associated steam and electrical equipment relatively peculiar to the use of nuclear energy for producing electric power.

Reactor Core . . . The reactor core is essentially a right cylinder, with vertical channels containing the fuel assemblies and control rods of the reactor. The core is assembled in a stainless steel, cylindrical casing, closed at the bottom by a perforated tube sheet and open at the top.

Fuel assemblies consist of a number of tubes containing uranium fuel-elements clad in thin metal. Channels in the core are also made of thin metal. The designed maximum surface temperature of the fuel-elements is 465 F.

D_2O is directed under a tube sheet upward through fuel-

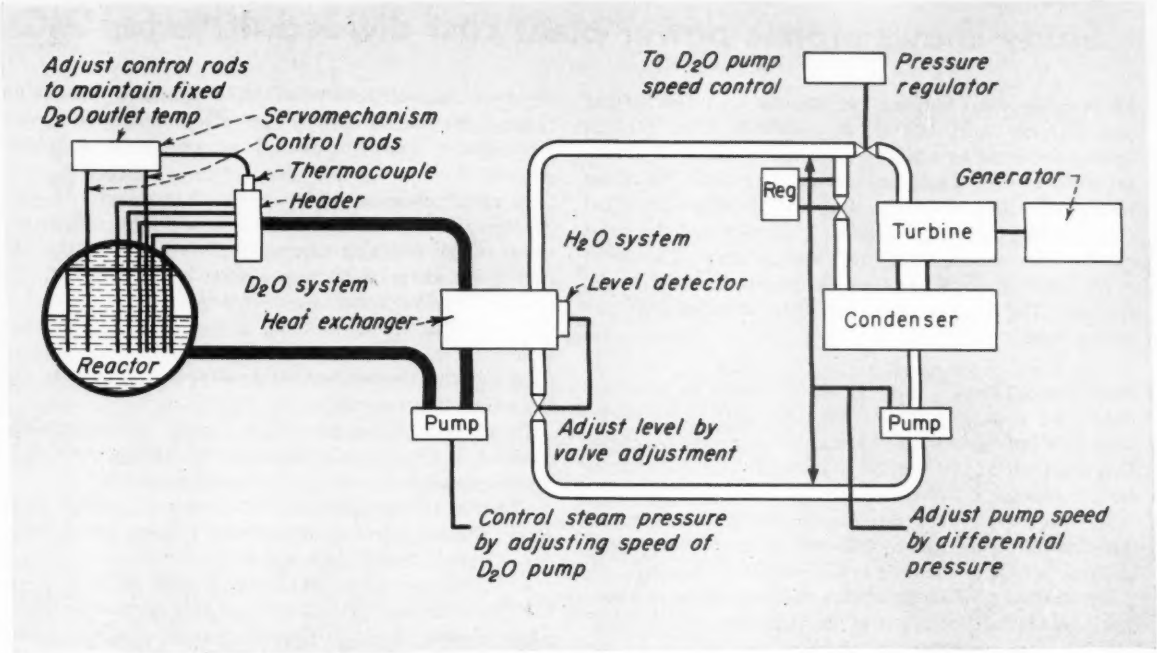


Fig. 5. BASIC CONTROL functions of liquid-cooled reactor, heat exchanger and turbine installation in hypothetical plant

to cost $558 per kw

elements and channels in the core, on to steam generators, then back to the reactor. Fuel assembly and control-rod channels are designed to provide passage of D_2O at a rate to obtain a maximum heat transfer coefficient of 9,400 Btu per hr per sq ft per degree F.

The D_2O surrounding the fuel-element channels acts as the moderator and that outside the cylindrical casing provides the reflector.

Reactor Shell . . . The reactor shell contains the reactor core, D_2O, and helium. It is designed to withstand internal pressure of 800 psi. Nine openings are evenly-spaced around the periphery of the shell, as inlets for D_2O. The shell, 2.14 in. thick and 20 ft 4 in. in diameter, is of Type 347 austenitic stainless steel. Such steel prevents corrosion and contamination of the D_2O. The same type steel is used in making pipe and other connections to the shell of the reactor.

Helium-Blanketing Purging System . . . A helium-blanketing purging system provides an inert covering wherever there is an interface in the D_2O circuit. Such interfaces exist within the reactor shell, outside the reactor core, and above the D_2O in the storage stanks.

Helium tanks have a storage volume of 2,000 cu ft. Half of the volume serves as a reserve supply for maintaining the blanketing-system pressure, operating between 800 and 1,000 psia. One-fourth of the volume receives returned circulating helium at slightly above atmospheric pressure. The remainder, at 120 psia, serves as a dump reservoir when the reactor exceeds the set relief pressure. The recombination of dissociation products is accomplished by using a catalyst.

Table 1.— Design Criteria and Specifications for Steam Generators *

Capacity, lb per hr	180,000
No. of units	18
Shell:	
Diameter, in	88
Over-all length, ft	24
Tubes (BWG):	20
Effective length, ft	18½
Outside diameter, in	⅝
Av. velocity through tubes, ft per sec	15.4
Coolant pressure drop, psi	35.0
No. of U tubes	656
Heating Surface:	
Evaporator section, sq ft	3400
Preheat section, sq ft	575
Total, sq ft	3975
Steam:	
Flow (total at 2.5 in. Hg), 10^6 lb per hr	3.25
Pressure, psia	180
Purity, ppm	1
Temperature (saturated)	373
Feed water:	
Preheater inlet temperature (2.5 in. Hg), F	109
Preheater outlet temperature, F	373
Coolant (D_2O):	
Design pressure, psia	800
Approx flow, 10^6 per hr	64.50
Evaporating section inlet temperature, F	440
Preheating section inlet temperature, F	401.3
Preheating section outlet temperature, F	388.8
Coolant holdup:	
Volume, each, cu ft	46
Weight, hot, tons	1.36
Total all units (no rods), tons	28.71
Total all units (rods), tons	20.80
Cost of coolant at $82.00 per lb	$4,708,440
Cost of steam generators, each	$80,000
Total Cost (for 18)	**$1,440,000**

* The tubes are stainless steel as are the coolant inlet and outlet boxes. The shell is steel. The tubes are bare.

Study shows atomic power plant cost divided 40% for D_2O,

Discharging and Charging The Reactor . . . Discharging and charging operations are accomplished, after a 12 hr shut down, by using a gantry crane and a suitable cylindrical coffin of lead. Spent fuel-elements are lifted out of the reactor core into the coffin and moved to a water-filled transport canal. Here the coffin is emptied and the spent elements are moved to a "hot" storage area. The coffin is refilled with fresh fuel-elements and is returned to the reactor. The fuel-elements are then lowered into the reactor core.

Radiation Shielding . . . The reactor shield is 8-ft-thick reinforced concrete, using limestone aggregate. Reinforcing is limited to that required for structural strength. The inner surface is steel skin 1 in. thick and the outer surface is steel ¼ in. thick.

A large part of the top reactor shield is formed by fuel-element channels, control-rod channels, and pipes leading from these channels to D_2O discharge headers.

The reactor shield supports the reactor shell using stainless steel brackets attached to the periphery of the shell. Brackets rest on rollers bearing on steel plates in the shield, providing for radial expansion.

Shielding in the remainder of the plant consists of 3-ft thick concrete floors, walls, and ceiling. Steam generators and pumps are shielded in individual cells so that they may be isolated for repairs, when necessary.

The walls and floor of the fuel-element transport canal have 8-ft-thick concrete shielding adjoining equipment and work areas from the radiation of spent fuel elements.

Reactor Control and Instrumentation . . . The quantity of D_2O flowing from the reactor core and its temperature are monitored by thermocouples and pressure taps at the fuel-element and control-rod channels. Thermocouples provide information for flow adjustments and pressure taps supply rate of flow data. A manually operated valve on each channel permits adjusting the flow distribution through the reactor core. Flow valve adjustments change the pressure tap readings and set new bases for comparison.

A rapid scanning device measures and records temperatures and pressures and localizes defects which develop. The scanning equipment has limit settings to initiate an alarm and cause automatic shutdown of the reactor when set limits are exceeded.

In addition, the radioactivity of the D_2O is continuously measured to assist in detecting fuel-element cladding failures. The temperature of the D_2O at the inlet to the reactor shell is recorded.

Discharged helium gas, which carries any dissociation products, is continuously monitored for radioactivity, D_2O content, deuterium content, and oxygen content.

Controls are designed so that automatic reactor shutdown, effected by control-rod drop, will be initiated by:

1. Loss of reactor shell pressure.
2. Excessive reactor (heat) power level.
3. Short reactor period, i.e. fast rate of reactor (heat) power change.
4. Fuel-element failure.
5. Serious D_2O leak.
6. Steam-generator failure.
7. Excessive radioactivity in reactor building.

Control rods are 1.5% boron steel, clad with stainless steel. Control-rod channels provide alignment to insure against jamming and shifting.

Certain control-rods are used to regulate the reactor (heat) power operating level of the core. They operate to maintain constant D_2O temperature in the outlet header when compensating for load variations and reactivity changes due to temperature changes affecting the core. These control-rods are actuated by a servo-mechanism which receives an input signal from thermocouples in the D_2O outlet header of the reactor.

The control-rod operating mechanism is a type of linear motor, mounted outside the reactor shell, that utilizes a magnetic field to position a magnetic slug fastened to the control-rod, inside the reactor shell.

Rods not used for automatic control are used as combination safety and shim-rods.

Reactor (heat) power level is determined by three methods: boron-coated ionization chambers, boron thermopiles, and heat-flow instruments.

Piping . . . Piping, which is of stainless steel, is held to a minimum by arranging the steam generators in a tight circle around the reactor and designing for a flow velocity of 25 ft per sec. This also reduces the amount of D_2O required in the system. (See Figs. 2 and 3.)

Steam generators . . . With 1,064 Mw (heat) power output and three turbines, the steam generators are of such capacity that the total number is an even multiple of three. This results in 180,000 lb of 180 psia (saturated) steam per hour from each of 18 units. Design specifications are given in Table 1 (See also Fig. 4.).

Coolant Circulating Pumps . . . Coolant circulating pumps present a major design problem in this reactor power

Table 2.—Design Data for Stainless Steel Pumps

Total coolant flow, 10^6 lb per hr	68.84
Pump capacity (9 units), 10^6 lb per hr	7.2
Pumpage, gal per min	15,300
Discharge pressure, psia	800
Suction pressure, psia	650
Developed pressure, psia	150
Developed head (2.45 ft = 1 psi), ft	368
Coolant inlet temperature, F	389

Table 3.— Design Data for the Three Turbogenerators

Steam pressure at turbine throttle, psia	175
Steam temperature (saturated) at turbine throttle, F	371
Exhaust pressure:	
Design, in. Hg	2.5
Operating, in. Hg	1
Steam flow:	
With 2.5 in. Hg back pressure, 10^6 lb per hr	3.21
With 1 in. Hg back pressure, 10^6 lb per hr	3.11
Total heat available in steam generator, 10^6 Btu per hr	3631
Capacity with 2.5 in. Hg back pressure (approximate), megawatts (three units)	228
Capacity at 1.0 in. Hg back pressure (approximate), megawatts (three units)	254
Standard 80,000 Kw Generator (13.8 Kv, ½ in. psig H_2, 1800 rpm	3

plant. This problem stems from the large quantities of D_2O to be delivered, the high suction pressure that must be sealed, the essentially low gland leakage permissible, the high D_2O temperature, and the radioactivity of the coolant. The design data are given in Table 2.

Pumps are single-stage overhanging impeller design with one gland exposed to suction pressure. The high temperature of the D_2O would cause "flashing" at this gland without special sealing; therefore, coolant at 100 F and a pressure above the suction is circulated to an intermediate position within the gland. This provides a flow of seal coolant along the shaft through labyrinthine packing into the pump in one direction and into an annulus in the opposite direction. Approximately 5 to 10 gal per min of seal coolant is required. A small external leakage from the gland exists and is collected in the annulus which is connected to a drain. The gland-seal coolant is supplied from the discharge of each pump, passing through a small heat exchanger before entering the gland. The drains are returned to the D_2O make-up tank.

Coolant Storage and Make-up . . . Four storage tanks lined with stainless steel and having a total capacity of 62,000 gal, provide for dumping all D_2O. The system includes a tank, pumps, filters, and a demineralizer. Pumps act to return valve gland leakage to the 800-psia, D_2O system in addition to filling the system.

Coolant Treatment System . . . D_2O exhibits the corrosive characteristics of light water at similar temperatures and pressures, and, as a result, the treatment system is designed to maintain chemical purity and inhibit radioactivity. The D_2O treatment system is shielded with 4-in. thick lead blocks to absorb radiation of dissolved solids in the D_2O.

Turbogenerator Units . . . The design data used by the manufacturer for estimates with respect to turbogenerator units are given in Table 3. The maximum size turbogenerator commercially available for the particular steam conditions pertaining to this plant design is 80,000 kw. Three of these are required.

In general, turbogenerator and auxiliary requirements are conventional other than the conditions brought about by the lower steam pressures of the design.

The low steam pressure and nonextraction cycle used require condensers that are very large. It is necessary to provide 130,000 sq ft of surface to attain a 1-in. Hg back pressure. Four condensers of 35,000 sq ft each per unit are planned to overcome the difficulty of installing one large condenser under each 80,000-kw turbine.

A 125,000-lb-per-hr demineralizing plant is necessary in this design to take care of a 4% make-up water requirement.

Control System . . . Control of steam and electrical output is basically conventional except for the considerations discussed below.

Reactor control-rods, actuated by a temperature controller, maintain a constant D_2O outlet temperature.

The (heat) power of the steam generators and in turn the kw output of the turbine, is controlled with the variations that occur in the flow of D_2O. These variations are produced by pump speed changes initiated by the steam pressure regulator on the steam production (H_2O) system.

A steam pressure regulator in the steam production system maintains desired pressure at the turbine throttle valve. A steam by-pass directly to the condenser is available for meeting other than normal operating requirements.

A simplified schematic diagram of the turbine and heat-exchanger (steam generator) controls appears in Fig. 5 on a preceding page.

Table 4.— Estimated Costs

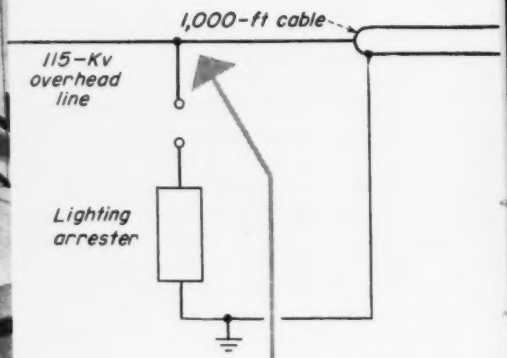
Equipment	Itemized costs	Totals
Reactor	$3,846,000	
D_2O system	3,172,000	
D_2O at $82.00 per lb	41,000,000	
Helium system	230,000	
Total	**$48,248,000**	**$48,248,000**
Steam generator plant	$4,178,000	
Turbogenerator plant	14,285,000	
Structural plant	10,024,000	
Misc. power plant equipment	342,000	
Electric plant	4,513,000	
Transmission plant	1,000,000	
Site	125,000	
Other land costs	1,500,000	
Yard improvements	830,000	
Miscellaneous:		
Operating tools, etc	300,000	
Spare parts	500,000	
Health physics	150,000	
Temporary construction	960,000	
Total	**$38,707,000**	**$38,707,000**
Research and development	$2,500,000	
Contingencies	8,700,000	
Engineering	4,500,000	
Total	**$15,700,000**	**$15,700,000**
Total direct cost		**$102,655,000**
Overhead, 15%	$15,345,000	$15,345,000
Grand Total		**$118,000,000**

Cost Estimates . . . A summary of detailed cost estimates is given in Table 4.

Fabricated fuel-elements were assumed to be furnished by others. Equipment costs were obtained from various manufacturers, consideration was given to the experience of others, a tentative site was selected, and an actual plant layout was made in establishing the estimates that appear in this study.

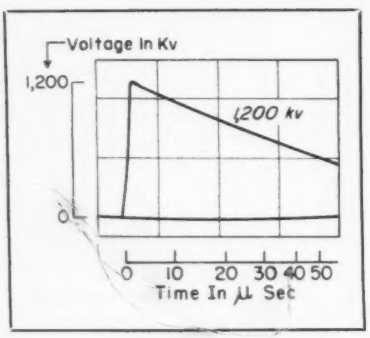
Examination of the figures indicates that approximately 40% of the cost is for D_2O and 20% is for the reactor, including the D_2O system, controls, and additional land and site development. The remaining 40% approximates the cost of parallel plant components of an equivalent conventional steam turbogenerator plant.

In the June 15 issue Electrical World will present the feasibility study of the Pacific G & E-Bechtel team.



Portable generator puts miniature surges . . . On line-end of cable.

L-V Surges Test Station



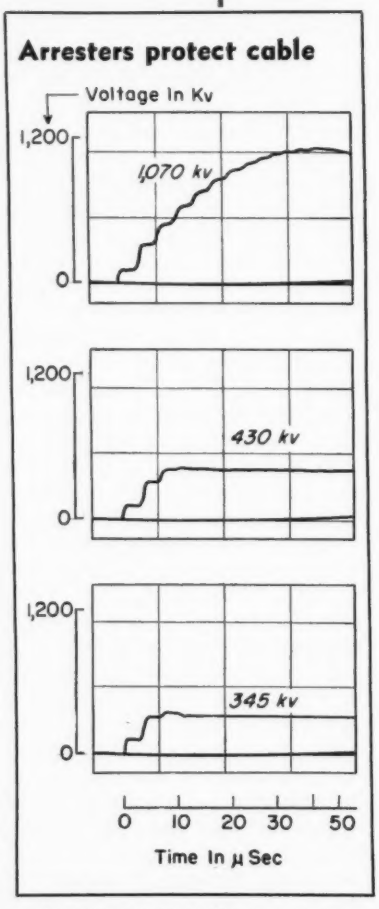
←This low-voltage 1½ x 40 surge is applied repetitively to line terminal of station entrance cable to simulate natural lightning stroke

J. M. CLAYTON, Electric Utility Engineer, Westinghouse Electric Corp., East Pittsburgh, Pa

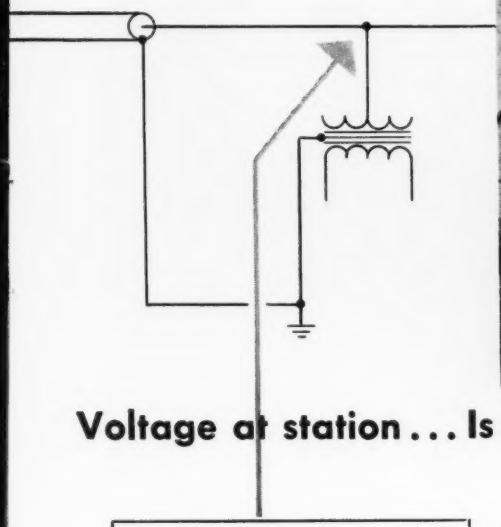
The Synchronograph provides a new method for simulating at low voltage lightning to determine the protection requirements of electrical systems and apparatus. Its use to determine the surge-voltage distribution at a typical transformer station supplied from a 115-kv, wood-pole line through a 1,000-ft length of cable is described in this article. The problem is to determine the lightning arrester application required to protect a transformer having a BIL of 450 kv against surges originating on the 1,200-kv BIL transmission line.

Because the generated surge repeats each cycle of the supply frequency, the transient phenomenon appears as a standing wave when viewed with a cathode-ray oscillograph. The transient at a point several miles away in the system under study can likewise be viewed with a similar oscillograph requiring no synchronizing interconnection other than a common 60-cycle source. These waves can be observed visually or photographed for permanent record even when of only a few microseconds duration. The entire system of instruments weighs less than 200 lb and can easily be set up wherever measurements are required.

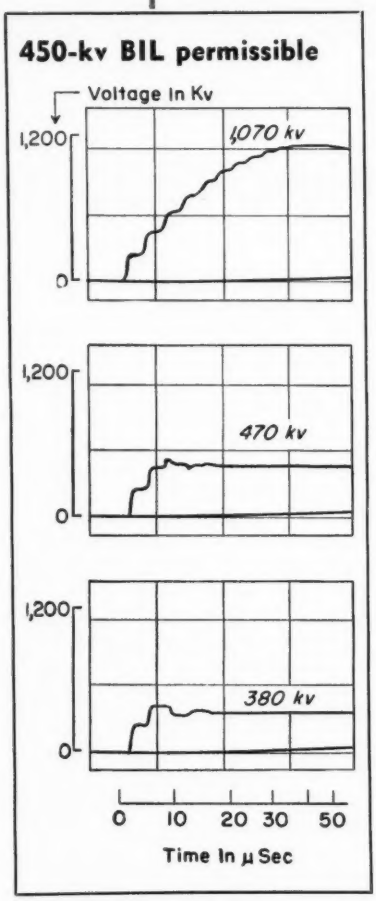
Wave shapes having fronts from 0.5 to 10 microseconds and tails from 5 to several hundred microseconds are readily generated. But here the stand-



VOLTAGE RISES TO 1,070 KV without protection. Conventional 121-kv lightning arresters limit to 430 kv (center) and 80% devices cut to 345 kv (bottom)



Voltage at station . . . Is measured to determine transformer stress



TRANSFORMER VOLTAGE is cut from 1,070 kv (top) to 470 by 121-kv arresters at line-cable junction (center) and to 380 kv by 80% equipment (bottom)

ard 1½ x 40 wave is applied and a surge of a few hundred volts represents a 1200-kv surge. When this wave is applied to the line voltage builds up to 1,070 kv at the line-cable junction and also at the transformer as shown by the top oscillograms.

With 121-kv lightning arresters (100% arresters) applied at the junction of the line and cable, the surge voltage at that point is limited to 430 kv. But the voltage at the transformer rises to 470 kv, as shown by the oscillogram. It is evident that these arresters do not adequately protect a transformer having a 450-kv BIL. Also the transformer would not be adequately protected by similar arresters at the transformer limiting the surge voltage to 430 kv. This value is only 20 kv below the transformer insulation level and the wave shape is more severe than a 1½ x 40 wave.

This demonstrates that the 550 BIL transformer must be used on systems that are not effectively grounded. Such systems require full-rating arresters. But in this application such a transformer would be adequately protected by full-rating arresters applied at the cable pothead only.

Safe for What Impulse Level . . . On effectively grounded systems (X_0/X_1 less than 3) arresters with reduced ratings can be used. In this case, 80% arresters at the cable pothead limit surge voltages to 345 kv at the pothead and 380 kv at the transformer. The bottom oscillograms provide these data. Study of the crest magnitude and wave shape measured at the transformer show it safe for 450-kv BIL.

The action of the arrester is simulated by an analog consisting of a battery and a rectifier in series. The battery opposes the surge voltage, and the rectifier permits current flow from line to ground only. When the surge exceeds the battery voltage, current flows to ground and is limited by the resistance of the rectifier. Adjusting battery voltage to represent breakdown voltage and the rectifier resistance to represent the arrester resistance permits various characteristics to be simulated.

Other Studies Can Be Made . . . Only a single wave shape and magnitude have been used in this example. However, the effect of wave shape and magnitude can be studied by simply switching to other valves.

Field measurements of this type are proving valuable because they include the effects of adjacent phase wires and steel structures, true characteristics of transformers and other equipment, and the attenuation and the distortion of cable. These factors are complicated to evaluate in calculations or analog computer investigations. But Synchronograph tests are improving analytical and analog computer techniques for solving lighting problems.

Beamed across Delaware River between Richmond Station and Camden . . .

Microwaves Protect New 132-Kv

GEORGE W. McKENNA, Senior Engineer,

FRED H. TRAVERS, Engineer, Electrical Engineering Division, Philadelphia Electric Co

More than a year of reliable service has proved the adequacy of microwave radio for relay protection of the new 132-kv interconnection between Philadelphia Electric Co's Richmond Station and Public Service Electric & Gas Co's Camden (N. J.) Switching Station. Despite the developmental nature of this equipment, it was selected as the most desirable means of providing pilot protection. Aside from 125 hours of development tests and measurements, its service availability has proven better than 99%.

The 132-kv line itself, about 2¼ miles long, follows the Pennsylvania-Reading Seashore Lines tracks through a growing industrial area. It crosses the Delaware River on the railroad bridge where the river is ½ mile wide and navigable for fairly large vessels.

Switching is on the 66-kv side of two 50,000-kva, 132–66–13.8-kv transformers at the Richmond ring bus. At Camden there are two 132-kv tie breakers, and there will be one direct-connected 55,000-kva transformer switched on the 26-kv side. Thus the relaying provides:

1. High-speed line protection.
2. Differential protection for each transformer.

The latter requires tripping at the remote end of the line as well as at the faulted transformer's breakers.

Microwave Selected . . . The requirements clearly indicated some form of pilot relaying. Microwave was selected only after more common methods had been investigated. Leased-wires would have required using a river crossing five miles downstream, giving unsatisfactory loop resistance and shunt capacitance. Carrier current required extra channels for remote tripping in both directions and was discarded because of complexity and cost. But microwave offered three distinct advantages:

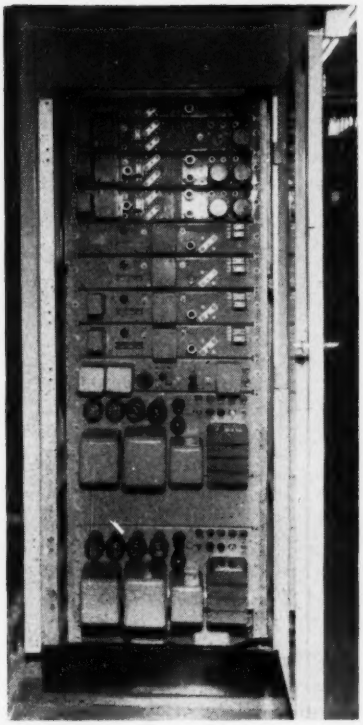
1. Lower cost.
2. Independence from the line.
3. Valuable experience for future installations.

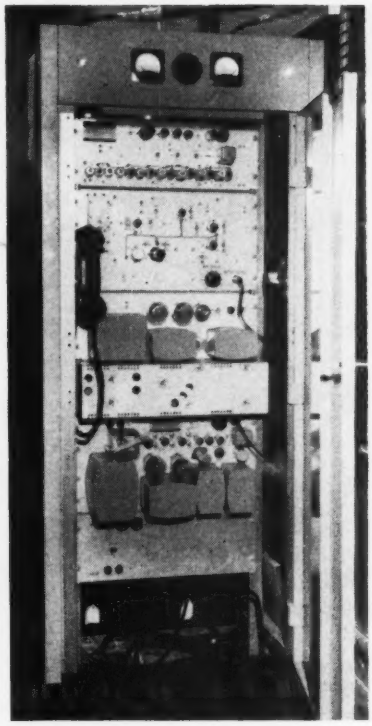
Line Protection . . . Distance-type, directional-comparison relays are used for line protection, similar to those for carrier current. This similarity and its advantages in installation, testing, operation and maintenance were important considerations. The microwave link transmits knowledge of the direction of current flow from each line terminal to the other. Requirements for tripping at each terminal are:

1. There must be fault current flowing into the protected line.
2. No blocking tone is received over the microwave link.

An "external fault" (not on the Richmond-Camden line) actuates the fault detector at the near end of the line to drop a tone from the normal 11,000 cps to 10,400 cps. This is the blocking signal to hold off the high-

Adapted from paper presented at a recent meeting of the Pennsylvania Electric Association Relay Committee





Tone Generators and Transmitter-Receivers Aid . . .

Interconnection

speed tripping of the circuit breakers at the far end. The near end relays see fault current flowing out of the line, hence do not trip their breakers regardless of whether blocking signals are received or not. But the far end relays see fault current flowing into the line and might trip incorrectly except that the blocking tone holds them open. Failure of the microwave can have no ill effects unless it occurs at this particular moment.

If the fault occurs on the Richmond-Camden line itself, fault current flows into the line at both ends. Operation of the phase blocking relays prevents both terminals from transmitting a microwave blocking signal. Thus the high-speed relaying is permitted to actuate instantaneous tripping. Staged tests prove the line can clear in 8 cycles.

Transformer Protection . . . Differential protection on the transformers at each terminal of the line uses two additional microwave tones to clear the far end of the tie line. Normally these tones are continuous at 3,475 cps and 4,875 cps. A fault in the transformer differential zone shifts these tones to 3,125 cps and 4,525 cps to trip breakers at the remote end of the line. To cause a transfer tripping operation the two higher frequency tones must be interrupted and the two lower frequency tones received. A staged fault in the Richmond differential zone clears in 15 cycles.

Should the microwave become inoperative, or be out of service for maintenance, the line backup relaying will clear severe transformer faults. There have been no incorrect operations of the microwave system since it was placed in service Dec. 29, 1951.

Additional Functions . . . The frequency zone from 250 to 2,500 cps is reserved for phone communication. This additional channel is completely independent of other communication facilities, which tends to guard against loss of regular communication.

A fourth channel of 13,000-12,400 cps has been provided as a spare in case of prolonged trouble on one of the other three.

Transmitter-Receiver . . . Substantially identical equipment is installed at both ends of the microwave link. The transmitter occupies the lower two panels and the receivers the upper three in the same cabinet. The Richmond transmitter and the Camden receiver are crystal controlled to 958 mc; the Camden-Richmond channel 954 mc.

Most of the vacuum tubes are similar to receiver tubes except those in the transmitter output stage. These are "light house" triodes for power output of one watt. Both transmitter and receiver are well shielded to prevent interaction.

Separate coaxial cables extend to the antennas on the roof. These antennas are dipoles at the focal point of 4-ft parabolic reflectors. Dipoles of one channel are horizontal, the other vertical, to further reduce interaction.

Multiplexing Equipment . . . The tone generators themselves occupy middle panels of the multiplex cabinet. These panels are identical except for differences in tuning. The top four panels are the tuned receivers which detect shift in tone frequency of transmission from the far end of the circuit to control breaker operations. The lower panels carry the voice auxiliary unit and two regulated power supplies.

Each terminal installation utilizes some 63 working tubes of 19 different types. Two of these, the 5814, and 12AT7, have shown average life below 3,000 hours. Even so, time lost for unscheduled maintenance of all kinds is less than 0.4%. Supervision is provided by continuous operation of the microwave link with normal tones of 3,475, 4,875, 11,000 and 13,000 cps. The control boards at both terminal stations include facilities whereby the operators can check operation of the microwave link, or make it inoperative. Line relay blocking signals can be sent from either end and checked at the other without affecting the 132-kv circuit. Likewise, because remote tripping requires simultaneous reception of two tripping tones, either one may be checked individually.

For utmost reliability, power to operate the microwave equipment is taken from the station batteries. Duplicate inverters are provided, each with a regulating transformer to maintain the 60-cps output voltage at 117 ±2 volts despite battery variations.

Making Power from Drinking Water

Central Hudson G & E and Rockland L & P will harness energy from New York City's water system for electric production

Another job has been found for New York City's drinking water. Miles and days before it reaches the faucets of the residents of the "big city" the water will spin the turbines at two modern hydroelectric stations. These are being constructed by Central Hudson Gas & Electric Corp and Rockland Light & Power Co as an adjunct to the City's Delaware Water System.

Both plants are located deep in the Catskill Mountains, near Grahamsville, N. Y. The 25,000-kw Neversink Station of Central Hudson is expected to go on the line as soon as water is available from the Neversink Reservoir. The other—the 18,000-kw Grahamsville Station of Rockland Light—will be ready for operation late in 1954, when the Pepacton Reservoir and interconnecting tunnel are scheduled for completion.

Central Hudson had two hydroplants on the Rondout Creek and owned four undeveloped plant sites; Rockland Light had a plant and two undeveloped sites on the Neversink River. The new Delaware Water Supply System of New York City diverts water from both streams.

After condemnation proceedings had been started by the Board of Water Supply of the City of New York, a settlement plan was negotiated which provided for the construction and operation of the hydroplants by the utilities and the use for generating purposes of an equivalent amount of hydroenergy for that lost to the utilities by diversion.

A naturally favorable condition existed for these developments because of the fact that New York City planned to pass the water from both the Neversink and Pepacton Reservoirs into the Rondout Reservoir. Differences in elevation between these reservoirs provided an average effective head of approximately 474 and 330 ft, respectively, available for hydrogeneration.

Central Hudson's damage claim of $2.5 million was based on:

1. Diversion by the city of practically all water from the Honk Falls hydroelectric station.
2. Diversion of a portion of the water previously available for the High Falls hydroelectric station.
3. Loss of water by diversion from four undeveloped sites owned by Central Hudson on Rondout Creek and redevelopment of the Honk Falls and High Falls hydroelectric stations.

DELAWARE WATER SYSTEM of New York City whose two reservoirs, Pepacton and Neversink, will provide the water for two hydroplants

NEVERSINK STATION of Central Hudson Gas & Electric Corp is now scheduled to put its 25,000 kw generator in service in early summer

Neversink Station is a 25,000-kw Peak-Load Generating Station

Availability of energy from the City water system formed the basis of the agreement that permitted Central Hudson to build the Neversink Station.

These are the terms of the contract between the City and the utility.

1. The company was permitted to construct a plant at the water outlet of the tunnel connecting the Neversink Reservoir with the Rondout Reservoir near the Rondout outlet.

2. Neversink Station will use 3.2 billion cu ft of water annually without cost to the company.

3. Water drawn in excess of this amount, an estimated 1.8 billion cu ft per year, will be paid for at the rate of $26.50 per million cu ft.

4. Water passing through the turbine will also supply the New York City water system.

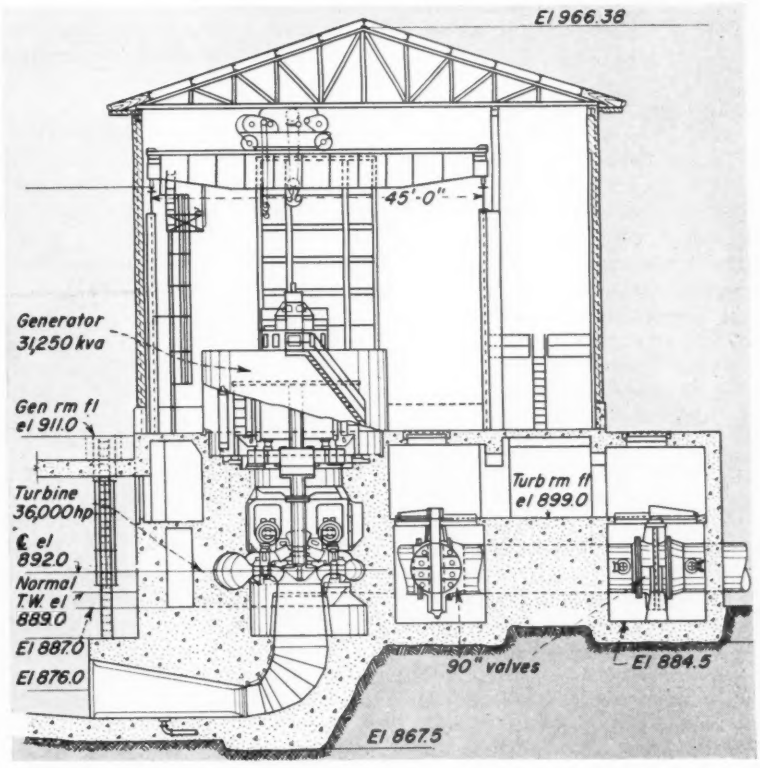
5. The City of New York will give Central Hudson an advance weekly estimate of the required water withdrawal from Neversink Reservoir so that the company can schedule its plant's operation to meet its peak load conditions.

6. Central Hudson will convey Station ownership to the municipality after 50 years.

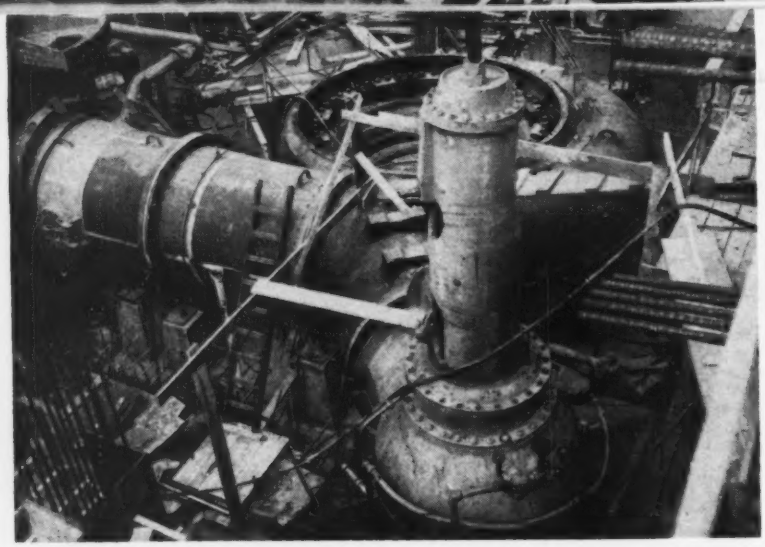
7. In the interim, revenue from the sale of energy will amortize the cost of the plant, cost of additional transmission lines, and the damage sustained by the company.

Neversink Station has been designed as a peak load plant as the normal weekly water requirements of the city from the Neversink Reservoir can be passed through the plant in 35-50 hr without excessive pressure loss in the 5-mile tunnel and conduit. Safe rated capacity of the Neversink supply is 105 million gal per day. Additional water can be withdrawn if desirable to both parties by extending the operating hours.

The City of New York has provided a by-pass system for water release whenever the turbine is shut



SECTIONAL DRAWING of the Neversink Station shows the 31.25 Mva, 0.8 pf, 60 C, 13.8 kv, 3-phase, 60 cps generator driven by a 41,000 hp, 300 rpm, 474 ft net head Francis turbine



PRESSURE REGULATOR (front) at Neversink Station was necessary because unfavorable terrain made cost of surge tank prohibitive. Regulator by-passes water around the turbine

down and water is required by the City through the aqueduct.

Hydraulic Design . . . A 5-mile long, 10-ft dia tunnel will carry water from Neversink Reservoir to the hydroplant. Water at the maximum rate of 785 sec-ft will enter the tunnel and travel at 10 fps to the turbine. A pressure of 206 lb will be built up at the turbine by the average effective head of 474 ft. From the turbine water will flow to the Rondout Reservoir and then through the Delaware Aqueduct to New York City, passing under the Hudson River near the town of Chelsea, N. Y.

A pressure regulator is provided because unfavorable terrain made the

Grahamsville Station of Rockland Light & Power Co. is similar to

The 18,000-kw Grahamsville Station is being built by Rockland Light under an agreement similar to that for the Neversink Station. Rockland's plant is located at the outlet of the tunnel connecting Pepacton Reservoir to Rondout Reservoir. This will be a base-load plant as water will be drawn continuously five days a week.

Contract terms between Rockland Light and the city are essentially the same as Central Hudson-City terms. However Rockland Light will receive 8.1 billion cu ft of water annually without cost and for excess will pay $17.50 per million cu ft.

A 26-mile long 11-ft 4-in. dia tunnel will carry water from Pepacton to Rondout Reservoir and thus to the plant. Net operating head for maximum generation will be around 330 ft. Velocity of water in the tunnel for maximum output is 7 fps.

A 41-ft 2-in. dia differential surge tank will be constructed. The upper 100 ft made of steel plate will protrude from the hillside; the lower three quarters will be in the rock hillside. Satisfactory water-hammer control is obtained with the tank so that a pressure regulator is not needed.

The turbine and generator are similar to those at Neversink. However, there is a difference in the ratings. Grahamsville's Francis turbine is rated 25,000 hp at 327 rpm when operating with 330-ft head. It drives a 20,000-kva, 60 C, 0.9-pf, 3-phase, 60-cps, 13.8-kv generator.

Energy from the Grahamsville station will be transmitted to the Rockland system over a single-circuit 69-kv, 35-mile line to the Shoemaker Substation in Middletown.

The one-line diagram of the station is simple, consisting of the 13.8-kv generator connected in sequence to the synchronizing air circuit breaker, to a 20,000-kva, 13.8-69-kv, main power transformer, to a gang-operated 69-kv line disconnecting switch and to the transmission line.

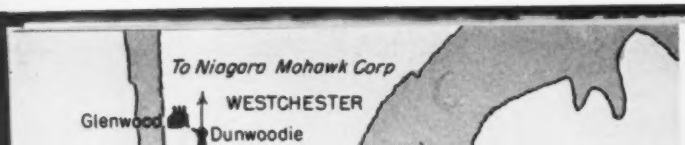
Automatic Control . . . The station will be completely automatic and the switchboard will be arranged to permit transfering the control from the normally remote control center at Middletown to the plant itself for operation by the local attendant.

Many protective features of the generator, transformers, and allied equipment are being incorporated in the design. The generator cannot be started if any of these malfunctions exist: inadequate governor oil pressure, low battery voltage, previous shut-down caused by over-speed, overheated bearings, loss of generator field, over-voltage, or turbine Dow valve not fully open. In most cases the unit will be locked-out, necessitating an attendant to visit the plant and locate and correct the trouble before restarting the unit.

An annunciator will give both visible and audible indications of the source of the initiating factor resulting in shut-down. This alarm will be transmitted by the carrier current supervisory system to the remote operator in Middletown.

The unit will be controlled by a code selector supervisory system from a central control point in Middletown. This equipment provides a means of selective control and automatic indication at the remote point of the equipment operations at the station itself. The system operates by means of a code consisting of a definite number of electrical impulses with time-intervals between pulses. Each piece of apparatus at the plant to be controlled has its own peculiar code and will not respond to any deviation from that code. A check-back feature ensures the correct reception of the code at the station and an acknowledgment to the remote operator to eliminate any change of an incorrect operation or indication from that intended.

Telemetering equipment will be installed to transmit, by carrier-current, over the 69-kv line to the remote operator, intelligence such as generator load in kw and reactive kva, voltage and water flow in cfs.



cost of a surge tank prohibitive. The pressure regulator is incorporated as a part of the scroll case and by-passes water from the turbine whenever there is a sudden loss of load and closure of the gates.

The regulator is directly connected to the gate operating ring of the turbine. On full-load rejection the wicket gates will close in 4.2 sec. The regulator opens full stroke in the same period and is set to close in 240 sec, limiting water hammer rise to 20%.

The 90-in. butterfly valves can be closed electrically from the dc battery in 300 sec if required.

General hydraulic design is based on a pressure of 312 lb. This may result from the improbable, but possible condition of the wicket gates remaining in an open position during full-load rejection. This would result in the turbine overspeeding accompanied by a reduction in water flow and subsequent water-hammer. Sufficient W R^2 is provided in the generator to reduce the rate of speed acceleration, and thus hold the overspeed and water hammer within the design limits.

Neversink's Francis turbine is rated 41,000 hp at 300 rpm when operating at 474-ft head. Stainless steel castings for runners, wickets, and removable throat rings are used in the turbine to reduce wear.

Electrical Design . . . The generator, mounted above the turbine, is rated at 31,250 kva, 0.8 pf, 3-phase, 60 cps, 13.8 kv and has a 60 C temperature rise. It is totally enclosed, air-cooled; the air in turn being water-cooled by heat exchangers around the stator periphery.

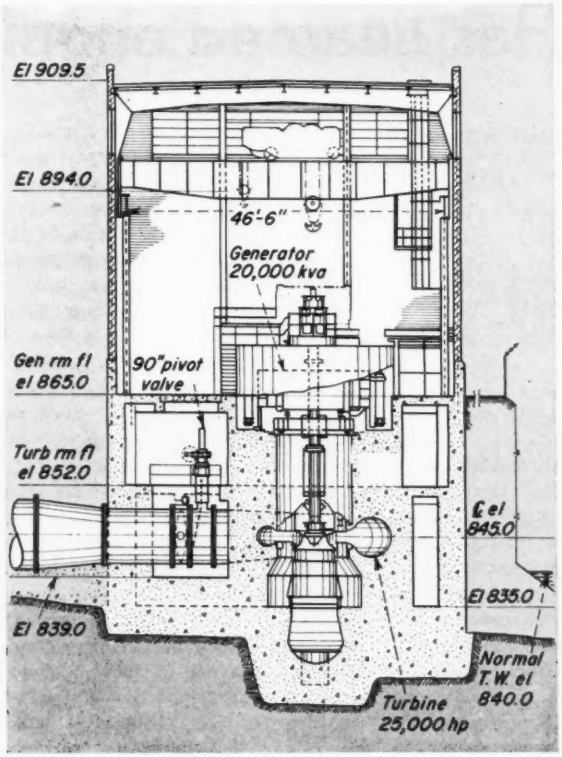
Under normal operating conditions, the machine is expected to generate 48 million kwhr each year.

Metal-clad switchgear, enclosed within the power house, is throat-connected to the generator. From these switches power cables run underground in concrete ducts to two 3-phase, 25-Mva, forced-oil air-cooled 13.8-66-kv transformers located in the switchyard which is immediately adjacent to the powerhouse.

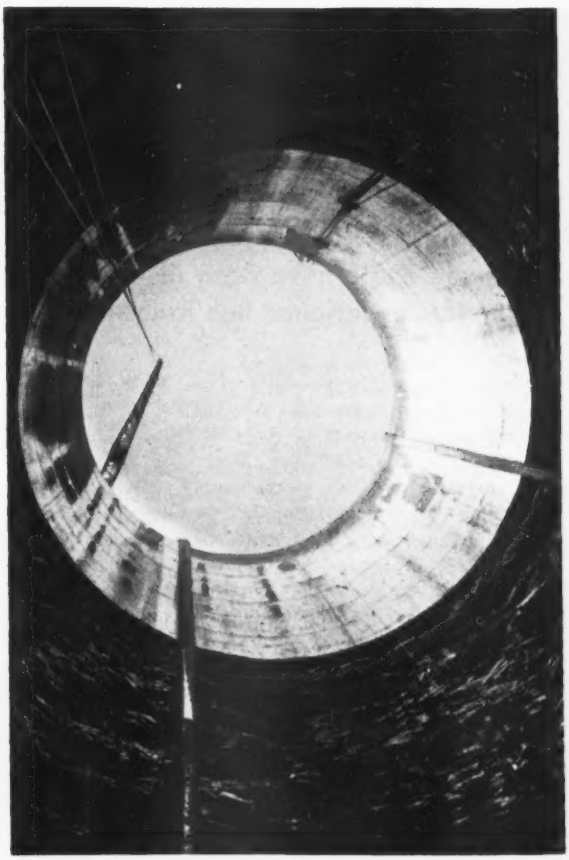
Neversink Station but a 18,000-kw Base-Load Station

Sectional Drawing Accentuates Unit Details

Photo Shows Projecting Steel Surge Tank →

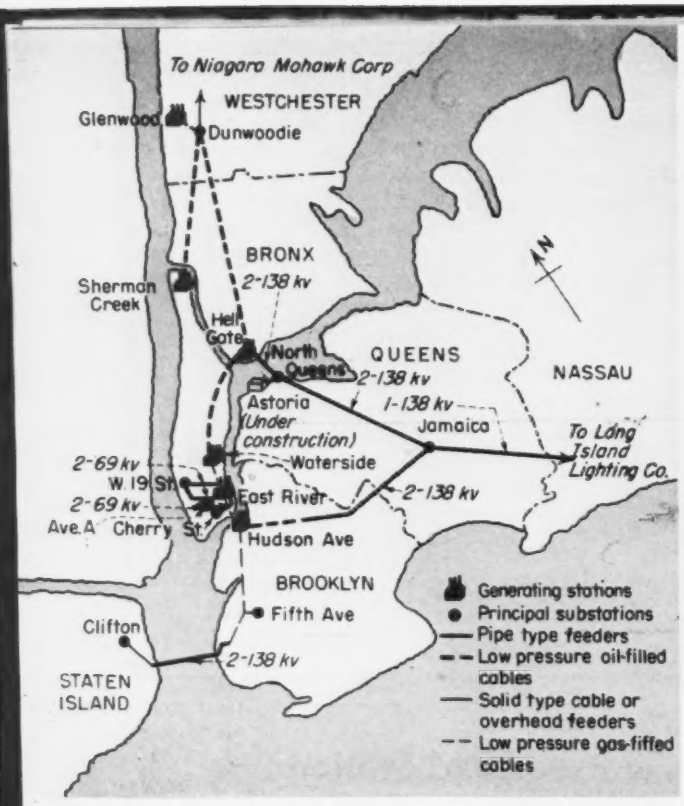


GRAHAMSVILLE STATION has a 20 Mva, 0.9 pf, 13.8 kv generator driven by a 25,000 hp, 327 rpm, 330 ft head Francis turbine

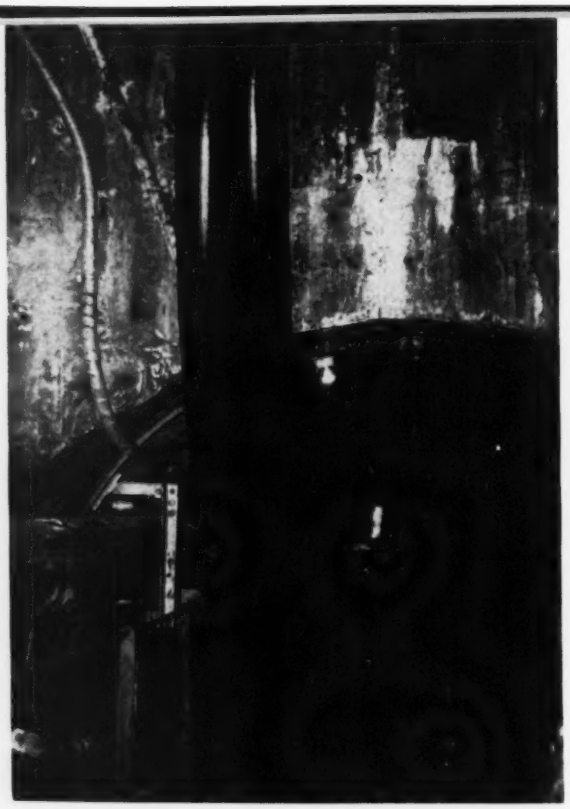


SURGE TANK at Grahamsville is built in hill and is extended above ground 100 ft by steel plates. This view shows excavation for tank

Future development work on pipe



LOCATIONS OF MAJOR PIPE-CABLE circuits on Consolidated Edison System are shown. In metropolitan area company finds such cables are superior for 138-kv station ties and as 69-kv feeders



LEAVING TUNNEL under East River, the 138-kv, Jamaica-Hell Gate pipe-cable ties rise 275 ft in a vertical shaft. Elevation difference increases oil pressure 100 psi but creates only the problem of support

What Con Edison Has Learned about

Since 1946 approximately 60 circuit miles of pipe-type cable have been installed in New York City. What this experience has taught is told here

R. W. GILLETTE, Senior Engineer, Electrical Engineering Department, Consolidated Edison Co of New York Inc.

Since 1946 pipe-type cable has played an increasingly vital role on the transmission system of the Consolidated Edison Co of New York. Such cable is used to interconnect generating stations and to supply new substations in growing load areas.

Today 21 pipe cable circuits are in service on the New York system. They total 58 miles. Nineteen operate at voltages of 69 kv or 138 kv. In addition, there are two 138-kv submarine cable circuits under the Narrows of New York Harbor between Brooklyn and Staten Island. These are being operated temporarily at 27 kv. Both high-pressure, oil-filled, pipe-type and compression-type circuits are in operation. All use oil as the pressure medium. During 1953 two more sets of 138-kv generator leads, employing pipe cable, will be placed in service.

Experience with these installations has confirmed early expectations, pointed to several possible economies in construction, and indicated need for research in several directions.

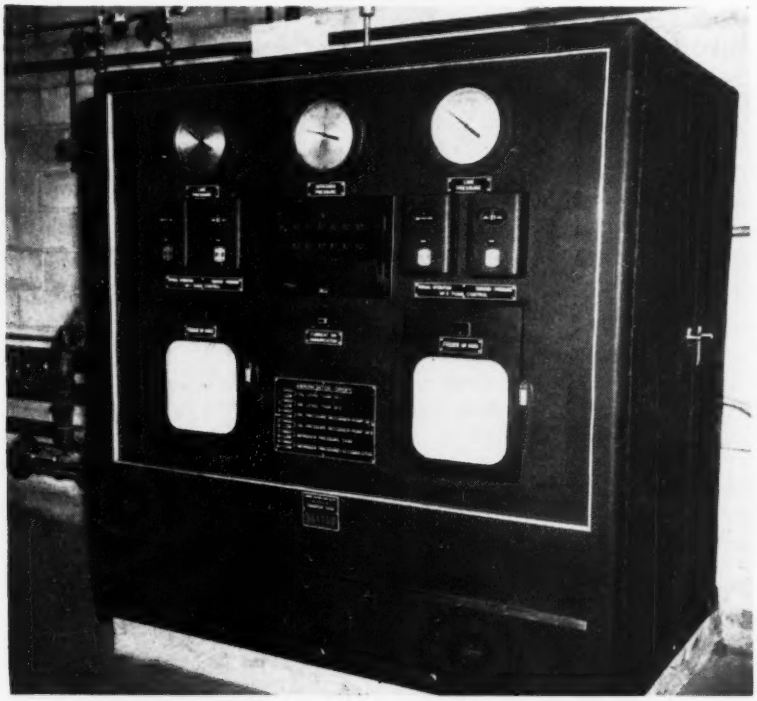
For instance: While installed costs have been in line with expectations, even further reductions can be made by using longer cable sections.

Elimination of the temporary lead sheath with which high-pressure, oil-filled, pipe-type cables were provided has been a step toward economy.

Safety heads are no longer used at semi-stop joints as there is doubt that they will rupture if failures occur. More accurate determination of the location of trouble would be required. There elimination has simplified the by-pass arrangements in the manholes. Fewer semi-stop joints are used in later installations with a consequent reduction in costs. In one type of semi-stop joint, developed by R. C. Rifenburg, no by-pass plumbing external to the joint casing need be used. This semi-stop design also incorporates automatic closing.

Considerable research has been devoted to investigating skid wire and shielding assemblies of these cables to arrive at the optimum in materials to be used and the suitable lay and to discover other factors influencing losses and coefficients of friction. This has resulted in substantial reductions in losses in recent designs.

Much data are also being gathered concerning the thermal characteristics of pipe circuits buried in the earth to aid in establishing ratings.



OIL PUMPING PLANTS, now standard on Consolidated Edison System, have extra set of control devices for reduced pressure operation so line pressure can be reduced with circuit out of service without changing the normal pressure settings. Duplicate pumps are provided

Pipe-Cable Application

It is believed that pipe cable failures, should they occur, might in some cases be repaired by making a joint at the point of failure, perhaps without the necessity of replacing any cable. In any event with the long section lengths now used it would be uneconomical and unnecessary to plan for the replacement of complete cable sections in the event of failures. It is the policy of Consolidated Edison to stock replacement cable lengths sufficient only to piece out as needed. Unless special conditions are known to exist, such lengths would be on the order of 250 feet.

Normal maintenance has proved to be low, as was originally expected. In a number of instances the pipes have been exposed and the somastic coating damaged by contractors who have made street openings to do work on sewers, water mains, and the like. In such cases repairs are readily made by pouring hot somastic mix into field molds such as were used to coat the pipe at the welded joints on the original installation. If such damage were done and no notification given to the company, the coating defect would be revealed by annual tests of the integrity of the coating on the entire line. The defect would then be accurately located and repairs made before the pipe corroded badly.

Rectifiers and batteries used for cathodic protection of the pipes are standardized items of equipment on which maintenance is almost insignificant. Likewise the pumping plants are composed of standard items such as the electric motors pumps, relief valves, pressure switches, gauges, valves, and pipe fittings. Once adjusted, these require little attention.

It is now the usual practice on Consolidated Edison installations to provide pumping plants with an additional set of control devices for reduced pressure operation. Thus if the line pressure is to be reduced for any reason when the line is out of service, it can be done without changing the settings of the pressure controls.

Future development work on pipe cables will probably include further study of fault location methods. While the one fault (caused by mechanical damage to the cable) which has occurred in New York, was located without delay by adaptation of existing methods, there is a possibility that under certain conditions more difficulty might be experienced.

Fault Easily Traced . . . The fault referred to did not burn a hole in the ¼-in. steel pipe wall and was cleared in approximately 8 cycles. While the fault condition was not sufficiently well established to permit immediate use of 220-v tracing current, the 10,000-v Thyratron immediately established a "condition" so that low voltage tracing current could be used. A 7½-v resistance bridge then was able to give an indication of the distance to the fault. By these means the fault was pin-pointed after digging only four test pits in 150 ft and then connecting the two pits between which tests showed the fault to be.

If the fault had burned through the pipe, there is a possibility that an outward flow of oil might have washed away the carbonized path and thus hindered the work of fault location.

It is known that fault location by microwave reflection, or "echo," has been used with success particularly on tower line power circuits and on communications circuits. This method, if developed for use on pipe cable, would constitute a useful tool.

Condenser discharge methods have also been used successfully.

Advantages Were Enticing . . . Consolidated Edison emerged from World War II with a considerable program mapped out for extending 138-kv transmission tie lines and feeders. For this service attention was directed toward high-pressure, pipe-type cable which seemed to offer advantages over lead covered cable in ducts:

1. It eliminated the lead-sheath which in duct cable systems is one of the greatest sources of trouble and makes for high maintenance cost.

2. Joints could be spaced further apart; accessories in manholes were much simplified; and the oil supply system, instead of requiring reservoirs, auxiliary gas tanks, and fragile tubing runs in various manholes along the route, could be concentrated at a single point on the feeder in the form of a pumping station.

3. In metropolitan territory many sub-surface structures exist such as water, gas, sewer and steam mains; communication duct banks, mail tubes, and rapid transit tunnels. In tight spots in busy street intersections, steel pipes of pipe-type cable systems can be installed where an additional duct bank adequate for cable to carry comparable loads would be nearly impossible to build.

4. Estimates of cost to install pipe cable indicated a cost saving of about 10% compared with low-pressure oil-filled cable.

First Three Circuits . . . As a result of studies commitments were made in 1946 for the installation of three 138-kv pipe-cable circuits. Two of these were companion feeders of the high-pressure, oil-filled type. Each of the two 8⅝-in. OD steel pipes in the common trench contains three single-conductor 1,500,000 cir mil cables. Each circuit was eight miles along and was supplied with oil by a dual pumping plant at one end of the line. Manholes were spaced at maximum intervals of 1,500 ft. All joints were semi-stop type and included external by-pass piping around the semi-stop features. In one line rupture disks, or safety heads, were incorporated in the by-passes to furnish an indication of the location of trouble if an excessive pressure should be developed by an electrical failure.

The third circuit, also eight miles long, was compression-type cable. This feeder was partly in Consolidated Edison territory and partly in that of the Long Island Lighting Co. There three single-conductor 350,000-cir mil cables were drawn into a steel pipe of 6 in. OD.

The cables had extruded polyethylene sheaths through which the 200-psi pipe oil pressure was transmitted to the cable insulation. The smaller conductor size and lighter weight made longer pulls feasible. Consequently manholes were spaced a maximum of approximately 2,000 ft. Semi-stop joints were spaced one mile apart on the Consolidated Edison portion of the line. All others were normal joints without the semi-stop feature. Manholes were air-conditioned during splicing to keep humidity low and reduce the likelihood of moisture entering points. A pumping plant is at each end of the circuit. One is normally used for pressure maintenance; the other is a stand-by.

Jamaica-Hell Gate Ties . . . As these installations seemed to justify expectations, pipe-cable circuits were again chosen when 138-kv ties were required between Jamaica and Hell Gate to complete the link between the Hudson Avenue Station, Hell Gate Station and upstate utilities.

Early experience indicated that these 1,500,000-cir mil circuits could safely have maximum section lengths of 3,000 ft. Moreover, it seemed practicable to eliminate the temporary lead sheath with which high-pressure, oil-filled, pipe-type cables had previously been provided if cable reels were sealed to retain a nitrogen atmosphere around the cable and exclude atmospheric air. Stripping of the temporary lead sheath in the field at the time of installation was thereby eliminated. Air-conditioning of the manholes was also discontinued. Thus operations were simplified and installation costs reduced.

The Jamaica-Hell Gate ties involved extending the lines under the Hell Gate channel of the East River in a tunnel having vertical shafts at either end of 250 and 275-ft depths. This elevation difference posed no problem for pipe cable because the additional 100-psi pressure was not excessive for a steel pipe. It was necessary to provide anchorages atop each shaft to support the cables.

69-kv Substation Feeders . . . Rapidly increasing loads in Manhattan have recently made it desirable to install substations in certain densely loaded areas. Each substation has been supplied by four 69-kv feeders from the East River Station.

In this instance the studies indicated that pipe cables would cost about the same as low-pressure, oil-filled type feeders. It seemed desirable to install two pipe-type circuits and two oil-filled circuits to the first substation, there being reason to believe that a good cost comparision would be afforded for the two types of system with comparable current carrying capabilities and with comparable rates.

The ideal comparison failed to materialize. The route of the pipe cables was a favorable one. An appreciable percentage of its length was in park area with a minimum of subsurface interferences, paving costs were low, and interference from traffic very small. The oil-filled cable route proved to be unusually difficult with a considerable amount of abandoned masonry to be removed, with many other interferences, and with paving to be cut and replaced.

Principally as the result of these circumstances the final installed cost of the pipe cable feeders, including the station terminal equipment and pumping plant, proved to be approximately 75% of the cost of the two oil-filled feeders. The second similar substation was placed in service in April 1952 and a third in May 1953; both supplied by pipe-type feeders.

Under the Narrows . . . During the summer of 1952 two pipe-cable feeders were placed in service under the Narrows of New York Harbor connecting Brooklyn and Staten Island. Each pipe contains three single-conductor, 1,500,000-cir mil cables. The underwater portion between submarine manholes is on the order of 6,750 ft making these the longest section lengths which have been pulled. The longest length installed previously on the Consolidated Edison System was 4,800 ft of 1,000,000-cir mil, 69-kv cable.

Initial operation is at 27 kv, and ultimate operation will be at 138 kv. During the period of 27-kv operation the oil in the pipe is maintained at a small positive pressure at the highest point instead of the nominal 200 psi which would be required for 138-kv operation.

Forced Cooling . . . A further advantage of pipe cable under special conditions dictated its selection for the leads of a generator at the East River Station between the generator transformer and the 69-kv station bus. This went into service in autumn of 1952. Because the circuit is short, approximately 600 ft between terminals, forced cooling of the cables could be used to advantage. This is done by circulating the pipe oil and passing it through an air cooled heat exchanger. This system of circulating oil for cooling has been successfully employed by the Public Service Electric & Gas Co, at Sewaren Station.

Subsurface congestion around the East River Station would have made it very difficult to find space for a duct bank to handle output of these generators. Without forced cooling, three pipe circuits of 1,500,000-cir mil, 69-kv cable would have been required, but with oil circulation and cooling only two are needed.

WASHINGTON COMMENT

JESSE MOCK

Cooperation May End G&T Loans

Rural Electrification Administration is toying with a new approach to solving one of its old problems. The problem is to assure an adequate and economic supply of power for rural electric co-operatives.

As banker to the co-ops the federal agency feels a responsibility to make certain there is sufficient electric energy available for the needs of its borrowers. Where there is no adequate source or outside supply, federal loans have been made for co-op generating and transmission facilities.

Democrats Let G&T Loans Hang . . . The large backlog of applications for these G&T loans is now worrying the new Republican administration. Some of these applications have been hanging fire for years. For various reasons, the former administrator did not dispose of them either by turning them down or approving them.

Even under the more liberal federal budgeting of the Democrats, it would have been impossible to finance any considerable share of these proposed loans through REA. With tighter rein over all loans for rural electrification such loans will be more than impossible.

Cooperation May Solve Problem . . . The new approach was hinted at in a recent speech by new REA Administrator Ancher Nelson. He told a Des Moines, Iowa, meeting: "We'll arrive at our goal a lot sooner and less expensively to the farmer and the people generally if we can hitch cooperative power, private power, and public power together in one team, all pulling in the same direction.

But putting this idea into effect calls for some new attitudes and new techniques at REA. In some areas there have been long and bitter controversies between the various real and potential power producers. Antagonism which has grown up must be arrested if co-op power supply problems are to be solved.

REA is considering use of informal conferences between the co-ops and potential power suppliers in an area to determine the situation and find possible solutions. REA officials would sponsor such conferences and sit in as advisers or in some other capacity. In effect, REA would be offering its "good offices" to individual co-ops in an effort to solve power supply problems. REA would be counting heavily that the problems could be solved without turning to federal loans.

Such conferences would be used initially to help dispose of the numerous G&T loan applications. Later they might be used at the earlier stages for meeting power demands of the co-ops.

Conference Plan Rarely Used by Democrats . . . Under the Democrats, this kind of get-together was used rarely. REA seemed to prefer to work with the various groups separately—talking with the co-op men at one time, electric company men at another, and other possible power suppliers at still another.

There were one or two trys at the conference idea. Back in 1947, such a conference was arranged to discuss a possible G&T loan in Texas. Electric company representatives sat down with co-op and REA officials to solve the problem. As it finally turned out, the co-op and the company worked out a power purchase contract. But the three-day conference presented a number of tense situations.

The big question on the conference idea is whether the attitude of the Republican Administration is such as to create an atmosphere of fairness for participants. With the right atmosphere and a spirit of cooperation it would appear that gains can be made.

But if the idea is turned into full and formal hearings on specific G&T loans, then more heat than light can be generated. Instead of saving time and solving problems, such a conference might have just the opposite effect.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Crossarm purchases by one utility amount to one for each 13 poles in service or 2½ for each pole added or replaced.

Vitreous aluminum silicate in blown fiber form resists temperatures up to 2,300 F and does not soften at temperatures approaching 3,000 F.

Higher primary feeder voltage (13.2 vs 4.12 kv) may be about 10% less expensive for overhead distribution in light load-density areas but equally more expensive in heavy load-density areas.

Average cost of meter reading for utilities with more than 400,000 customers was 73 cents per year in 1949.

A car dumper may well be economically justifiable for a generating station that burns as much as 2,000 tons of rail coal a day.

Secondaries often constitute more mileage of circuit than any other segment of the distribution system. Therefore, they are entitled to analysis.

Overloading of transformers naturally increases the corresponding encroachment on the total voltage drop available between substation and customer's meter.

Utility with 428,000 **poles in service** adds about 9,000 poles a year and replaces about 4,000 that have reached the end of their service life.

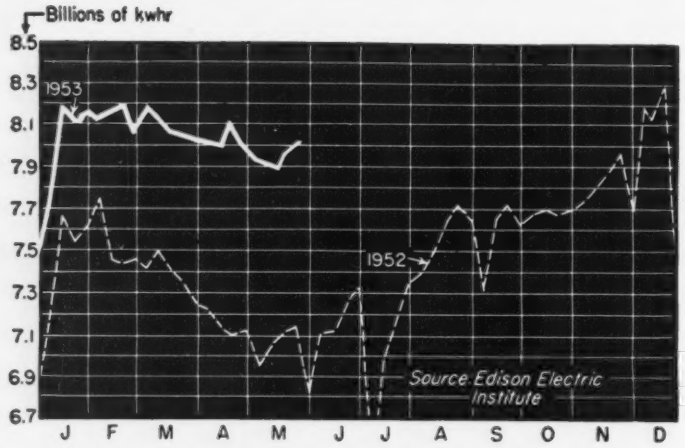
Higher voltage (say 460) than 240/120 for secondaries might lop off $1 to $10 in distribution investment per customer but is this enough to carry the added safety risks and the transition costs and headaches?

Single-phase air-conditioning units (¾ hp and up) are generally equipped with shunt capacitors to meet NEC requirements for load on general purpose house circuits. These capacitors in improving power factors, aid the utilities in reducing operating current and voltage drop.

Lower flux density is a first-blush solution for transformer noise but hardly an economic one because it affects all component costs disadvantageously.

Meter terminals and enclosures of the moderate load era will often not accommodate the larger secondary conductors needed for today's loadings.

STATISTICS



Output Week Ended May 23—8,012,902,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
May 23	+12.1	+12.3	+9.2	+9.9	+10.8	+19.4	+13.1	+11.5	+15.2	+7.9
May 16	+11.9	+11.5	+8.6	+10.2	+11.1	+17.9	+13.0	+11.8	+13.2	+11.0
May 9	+12.2	+13.3	+10.4	+12.2**	+12.4	+18.7**	+4.7	+12.5	+9.0	+10.3

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	Mar.	73.5	73.3	67.1
Capacity (Million Kw)	Mar.	83.17	82.83	76.34
Production (Billion Kwhr)	Mar.	36.97	33.60	33.04
Hydro		10.20	8.99	10.44
Fuel		26.77	24.60	22.60
Fuel Consumption				
Coal (million Tons)	Mar.	9.44	9.16	8.84
Oil (Million Barrels)		8.08	6.81	5.22
Gas (Billion Cu Ft)		70.16	57.82	57.39
Sales (Billion Kwhr)	Mar.	31.73	31.21	29.03
Residential		9.10	9.31	8.32
Commercial		5.18	5.17	4.85
Industrial		15.36	14.76	13 98
Other		2.09	1.96	1.87
Net Income Class A & B Companies ($ Million)	Feb.	98.39	98.55	88.41
Estimated Dec. '53 Peak (Million Kw)	Feb.	86.5	87.0	89.1
Kwhr per Residential Customer (12 Month Average)	Feb.	2,195	2,183	2,037
Revenue per Kwhr Residential Service (12 Month Average)	Feb.	2.76¢	2.77¢	2.80¢
Canadian Production (Billion Kwhr)	Mar.	5.78	5.26	5.22

Business Statistics

FRB Industrial Production Index†††	Apr.	241*	240	215
Gross National Product Annual Rate ($ Billion)	4th Qtr.	355.2*	343.0	337.1
E. W. 5 Industry Production Index	Apr.	131.1	130.8	118.8
ENR Construction Cost Index††	Apr.	123.6	123.2	116.2
BLS Consumer Price Index	Mar.	188.8	188.6	188.0
NEMA Insulation Materials Sales Index†	Mar.	694	649	536
NEMA Electric Appliance Sales Index†		356	306	278
NEMA Household Refrig. Sales Index†		211	208	163
Metal Prices (May 20)				
Copper, Conn. V., lb		$ .29¾	$ .29¾	$ .24½
Lead, N. Y., lb		.13	.12	.15
Zinc, prime Western E. St. Louis, lb		.11	.11	.19½
Tin, Straits, qual. N. Y. lb		.99	.93½	1.21½
Aluminum, ingot, base price		.20½	.20½	.19
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		59.00	59.00	56.00
Steel, scrap, No. 1 heavy, Pitts., ton		45.00	45.00	45.00

* Preliminary ** Revised † 1936=100 †† 1949=100 ††† Unadjusted

United Nations Reports On Installed Capacity

Data on installed capacity released by the United Nations shows that the United States is the world leader.

No data is available on USSR but production affords some measure of capacity. In 1951, the UN estimates, USSR production was 104 billion kwhr, 90.3 billion in 1950.

Generating Capacity
Thousands of Kw

	1951	1946	1941
Africa			
Algeria†	236	184	181
Angolia	18.4*	9.1	7.6
Belgian Congo	168	—	—
French Morocco†	174	87	86
Gold Coast	65	—	—
Mozambique	26.8	15.4	14.2
Nigeria	43	—	—
N. Rodesia	160	—	—
Tanganyika†	22	—	—
Tunisia†	66	32	46
Union S. Africa	2,405*	—	1,784
North America			
Canada†	9,960*	8,312	7,018
Cuba†	168	138+	—
Mexico	1,235*	894	681
Panama	20	15	12
Puerto Rico†	200	—	—
Trinidad†	17	18	5
United States	90,128	63,065	53,995
South America			
Argentina	—	1,444	—
Brazil	1,883	1,415	1,261
Surinam	4.64	1.72	0.85
Asia			
Ceylon	42	14	15
Hong Kong†	106	56	86
India	2,409	1,301†	1,148†
Israel	139	—	—
Japan	10,808	10,251	9,431
Philippines†	167.4	—	—
Singapore†	37	32	32
Thailand	32*	23	32
Turkey	424	248	222
Europe			
Austria	2,070	—	—
Belgium	3,170	2,656	—
Denmark	1,076	800	754
Finland	1,286	929	888
France	15,900	11,726	10,519
West Germany†	7,822	5,414	—
Greece†	223	126	130
Iceland†	44	—	—
Ireland†	266	200	181
Italy	8,788	6,002	6,224
Luxembourg	146	141	134
Netherlands	—	2,142	1,913
Norway	3,156	2,441	2,191
Portugal	555	315	279
Spain	2,382	1,756	1,523
Sweden	5,085	3,745	2,956
United Kingdom†	16,895	12,546	—
Yugoslavia	775*	631+	—
Oceania			
Australia†	2,478	2,053	1,765
New Zealand†	725	585	460

Source: United Nations Statistical Year Book
* 1950
+ 1947
† Public utility plants only

FINANCIAL

WWP-PUD Battle Brewing . . .

. . . before Washington PSC over Puget Sound P&L merger. Puget takes neutral stand because of another purchase offer and leaves Robinson's company to fight for private enterprise

The Washington Water Power Co was left virtually alone to bear the burden of convincing the Washington State Public Service Commission that its proposed merger with the Puget Sound Power & Light Co is in the public interest. Puget took a neutral attitude as a public hearing began recently before the commission.

Lowell P. Mickelwait, counsel for Puget, said his firm was taking a neutral stand because of its involvement in a purchase offer from a group of PUD's.

Hearing Intervenors . . . Five PUD's, the Washington State Association of PUD's, the Jefferson County Telephone System, Inc, the State Federation of Labor, and the State Grange were permitted to enter the hearing as intervenors over the bitter opposition of Alan Paine, attorney for WWP.

Paine contended the PUD's and their allies had no place in the hearing because they wanted to bring up the issue of public versus private power, not a matter to be determined by the commission. He predicted the PUD's would try to show that their proposed purchase of Puget was better than the merger.

"That is clearly outside the jurisdiction of this commission," Paine declared. "This commission has merely to decide whether the merger is in the public interest."

Protect Public Interest . . . The PUD representatives countered that their appearance was "to protect the public interest" and that they represented "a segment of the public that is most vitally interested in this proposed merger." They pointed out that state law charges the PUD's with the "duty of conserving water and electric power for the people of this state and this merger certainly has to do with the conservation of power."

The PUD's asked the commission to dismiss the merger applications, arguing the companies first should get consent to merge from their stockholders. Paine termed this request as an attempt to reverse the natural order of the proceedings. He said the companies had to know whether they could merge as far as the commission was concerned before they could go to the expense of submitting a detailed proposal to every stockholder and the Securities and Exchange commission.

He further charged the PUD's with "delaying tactics" and told the commission that the merger would result in increased efficiency, economy, and improved facilities.

J. W. Bryan, chairman of the Kitsap PUD, took issue with the other PUD's, repeating his approval of the merger. He called the PUD's statistics "outrageous."

Mr Private Power Speaks . . . Kinsey M. Robinson, president of WWP, told the PSC, "If the merger is consummated, the resultant saving and the improved financial condition of the company will allow the merged company to give good service without any rate increase in the foreseeable future."

He asserted that the merger of the two companies would help alleviate the Northwest power shortage because the larger capital structure resulting from the merger would enable construction of hydro dams costing in excess of $75 million.

The WWP president also said that under the merger the combined system would be divided into eastern and western divisions with "a top responsible executive officer in charge of the western division who will reside in the Puget Sound area." He expressed the opinion that integration of the two systems would enable a saving in operations of more than $1 million a year.

As the result of an advertising program by the PUD's, the commission had been flooded with postcards commenting on the merger, with the count running about 3 to 1 against the merger. Among organizations that have voiced opinions, chambers of commerce generally favor the merger while grange and labor groups are against it.

E. W. Anderson, a member of the PSC, declared that "these letters from individuals and organizations will have no effect upon the commission's ruling." The decision will be based upon the facts brought out at the hearings, he said.

If the commission approves the merger, Federal Power Commission is expected to conduct another hearing, as is SEC. Idaho Power Commission may enter the picture because WWP has facilities in that state. Should approval of the regulatory agencies be secured, stockholders of the two companies then would vote on the merger proposal.

Stockholder Relations Booklet Issued by AMA

"As a small group of professional investors control the investment opinion today, they should receive the major share of attention in an effective program of stockholder relations," says a booklet "A Company Guide to Effective Stockholder Relations," released recently by the American Management Association.

This does not mean, Emery N. Cleaves, vice president, Celanese Corp of America, points out in the book, that "any conspiracy or unanimity of opinion exists within this group." But the individual stockholder lacks the time and training to evaluate companies' financial statements and tends to rely on his professional financial advisers. Therefore bankers, trust investment officers, investment counsel, financial analysts, and customers' brokers should be the chief target of an information program designed to insure a favorable long-term market for a company's securities.

The key role of the professional investor in the financial market is emphasized in the section on the role of the security analyst. A. F. Tegen, president, General Public Utilities

Corp, tells how his company fits the analyst into its stockholder relations program.

The 60-page booklet was written by a group of security analysts under the chairmanship of John F. Childs, vice president and head of the utility department of the Irving Trust Co, with contributions by corporate executives and regulatory agency representatives. It covers the subject of stockholder relations from the viewpoint of the investor-owned corporation, with attention to the role of the security analyst and the implications of the federal law.

Copies are available from the American Management Association, 330 West 42nd St., New York 36, N. Y., at prices of $2 to non-members of the association and $1.50 to members.

3 Oregon Utilities Won't Get Entire Surcharge

Three Oregon electric companies will have to absorb about $627,000 of the excess steam generating costs imposed by last winter's water shortage. This sum represents the difference between the $4,642,000 collected through surcharges on customers bills and the $5,269,000 the companies consider recoverable as excess cost.

Charles Heltzel, Oregon public utility commissioner, has ordered Portland General Electric Co and Pacific Power & Light Co to drop the surcharge at the end of May. Mountain States Power Co dropped the levy in mid-May.

Of the $627,000 Pacific P&L will have to absorb $185,000; Portland GE, $300,000; and Mountain States, $142,000.

Washington Public Service Commission directed Pacific P&L, which has customers in six counties of that state, to drop the surcharge by May 28.

FINANCIAL BRIEFS

Public Service Electric & Gas Co has postponed a $50 million first and refunding mortgage bond issue which was scheduled for sale sometime in June. Current high cost of money was blamed for the action . . . **Washington Water Power Co** will pay June 15 a quarterly common dividend of 40¢ a share as compared with 37½¢ a share previously.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stocks			Common Stocks		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
May 21	**3.34**	**3.45**	**3.65**	**4.34**	**4.58**	**4.80**	**5.11**	**5.67**	**5.85**
May 14	3.37	3.46	3.68	4.37	4.59	4.79	5.12	5.57	5.91
END OF QTR.									
1st 1953	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62
3rd 1952	2.99	3.03	3.16	4.10	4.26	4.61	5.18	5.59	5.96
2nd 1952	2.95	3.00	3.09	4.05	4.31	4.60	5.38	5.85	6.42

Data: Reis & Chandler, Inc.

EARNINGS

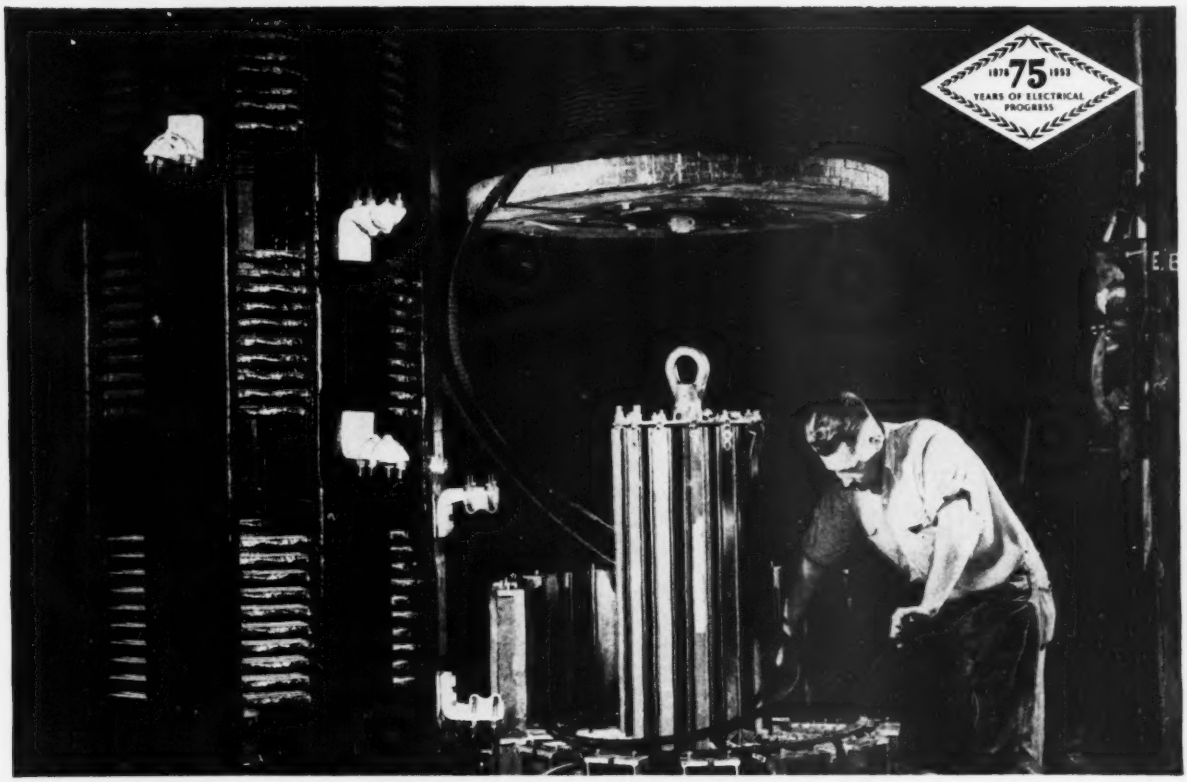
Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
California-Pacific Utilities	12	April	$543,149	$503,648	$2.03	$1.88
Carolina Power & Light	12	April	7,138,676	6,520,821	....	....
Central Illinois Light	12	April	3,267,943	3,117,726	3.07	2.91
Citizens Utilities	12	Mar.	836,359	697,057	0.95	0.79
Cleveland Electric Illuminating	12	Mar.	13,059,310	11,892,650	3.56(a)	3.21(a)
General Public Utilities, consolidated	12	Mar.	19,113,293	15,575,890	2.24(b)	1.83(b)
Georgia Power	12	April	12,099,666	10,747,609	....	....
Minnesota Power & Light	12	April	3,528,013	3,278,750	3.44	3.15
New York Electric & Gas	12	April	7,859,261	7,030,465	2.48(c)	2.49(c)
Ohio Edison, consolidated	12	April	17,319,310	14,471,139	2.85(e)	2.71(e)
Pennsylvania Water & Power	3	Mar.	319,327	361,036	0.55	0.64
Southern Co. consolidated	12	April	20,770,166	18,867,842	1.20(f)	1.71(f)
Southern Indiana Gas & Electric	12	April	1,974,173	1,740,023	1.95(g)	1.94(g)

Notes—(a) Based on 3,342,308 shares; (b) Includes all subsidiaries and is based on 8,531,329 shares; (c) Based on 2,696,950 shares in 1953 and 2,396,950 shares in 1952; (e) Based on 5,278,306 shares in 1953 and 4,798,460 shares in 1952; (f) Based on 17,255,525 shares in 1953 and 16,072,159 shares in 1952; and (g) Based on 799,167 shares in 1953 and 685,000 shares in 1952.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF MAY 21-27			
Bonds			
Potomac Electric Power—1st mtg 3⅛% due 1988	$10,000	102%	3.77%
Common Stock			
Potomac Electric Power—852,840 sh (being offered commonholders on 1-for-5 basis, record May 27 to expire June 10)	$13,645	$16.00	6.25%
SCHEDULE FOR MAY—JUNE			
Bonds			**Bid Date**
Iowa Public Service—1st mtg due 1983	$7,500	.....	June 2
Consolidated Gas, EL&P of Baltimore—1st mtg due 1983	25,000	.....	June 9
Gulf Power—1st mtg due 1983	7,000	.....	June 9
Los Angeles, Calif., Department of Water and Power—revenue	5,000	.....	June 9
New Jersey Power & Light—1st mtg due 1983	5,500	.....	June 9
Arkansas Power & Light—1st mtg due 1983	18,000	.....	June 10
Pennsylvania Electric—1st mtg due 1983	12,500	.....	June 30
Metropolitan Edison—1st mtg due 1983	8,000	.....	.....
Preferred Stock			
Public Service Co of Indiana—600,000 sh $25 par	$15,000	.....	June 3*
Kansas Power & Light—50,000 sh $100 par	5,000	.....	.....
Western Light & Power—78,202 sh (one sh of preferred to be offered to commonholders for each five shares held of record June 9)	.....	.....	.....
Common Stock			
Rochester Gas & Electric—175,000 sh (to be offered commonholders on 1-for-7 basis, record May 28 to expire June 12)	$.....	.....	.....
Texas Utilities—375,000 sh	.....	.....	June 2
American Gas & Electric—800,000 sh	.....	.....	June 9
New England Electric System—828,516 sh (to be offered commonholders on 1-for-10 basis, record June 11 to expire June 25; company will name subscription price on June 8 and open bids June 10 for underwriting fee)	.....	.....	June 10
General Public Utilities—568,665 sh (to be offered commonholders on 1-for-15 basis, record June 2 to expire June 24 with oversubscription privileges)	.....	.....	.....
Public Service of Indiana—472,596 sh (to be offered commonholders on 1-for-8 basis, record June 2 to expire June 17)	.....	.....	.....
Gulf States Utilities—350,000 sh	.....	.....	June 23
Derby Gas & Electric—47,039 sh (to be offered commonholders on 1-for-6 basis; unsubscribed to be offered to officers and employees)	.....	.....	.....
Boston Edison—246,866 sh (to be offered commonholders on 1-for 10 basis)	.....	.....	.....
Kansas Power & Light—170,000 sh	.....	.....	.....
San Diego Gas & Electric—800,000 sh (to be offered on 1-for-3 basis, record June 9 to expire June 24; unsubscribed shares up to 100 to be offered employees)	.....	.....	.....

Notes—* Blyth & Co, underwriter.



Save 10% on new G-E reactors with aluminum conductors

Same long life, same low maintenance, same high short-circuit strength . . . at 10% less cost

Now you can save 10% by buying General Electric cast-in-concrete reactors with *aluminum conductors*. These new G-E aluminum reactors will give you the same dependable performance—the same high degree of protection—as G-E units built with copper . . . at 10% less cost. There has been no sacrifice in the reactor quality that has been the favorite of industry for more than 35 years.

The "extra service" features of G-E reactors—both aluminum and copper types—that provide practically unlimited life and make maintenance a minor factor, include:

Non-aging glass insulation which assures greater protection against turn-to-turn short circuits than any other type of wound insulation used in reactor manufacture . . . withstands extremely high temperatures . . . remains unaffected by moisture and will not deteriorate even under high overloads.

Continually transposed conductors assure more uniform current-distribution : : : reduce losses, and increase short-circuit strength.

Wet steam curing assures full strength of concrete at shipment—no dangerous waiting period which occurs if concrete must cure after reactor is placed in service.

Other features include: good clearances; crossovers made within concrete supports; smooth, flameproof black japan finish and silver-plated terminals.

Metal housings, with provisions for cable entrance and exit can also be provided that will match the appearance of G-E switchgear. These housings minimize stray currents and electrical losses, protect reactors against damage, and increase safety for personnel.

You can buy these sturdy, dependable G-E cast-in-concrete reactors with either aluminum or copper conductors. For full information contact your nearest G-E Sales Office or write General Electric Company, Section 422-5, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

READY TO START moving the 750-kva General Electric network transformer, with submersible protector, from trailer to vault. Notice the room air-conditioning units in the windows—one of the reasons why more capacity is needed here.

Potomac Electric, Washington, D.C., installs G-E network unit to meet extra-heavy load demands

System reinforced with 750-kva G-E transformer and network protector

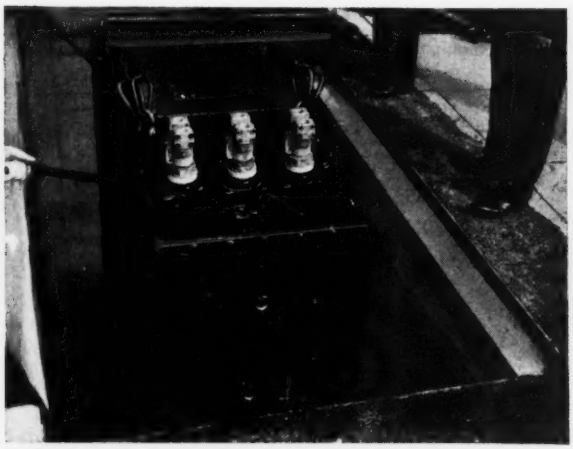
The flexibility and ease of expansion provided by a secondary network system certainly "pays off" for Potomac Electric Power Company in downtown Washington, D. C. Flexibility of the system permits load growth additions with minimum interference to service in the highly concentrated downtown area.

The financial district is experiencing a phenomenal growth and the consequent heavier load requirements, including air-conditioning in existing buildings in the area, necessitated installation of this 750-kva G-E network transformer. The unit, equipped with a submersible automatic network protector, is located at 730—15th Street, N. W., directly in front of the American Security and Trust Company building.

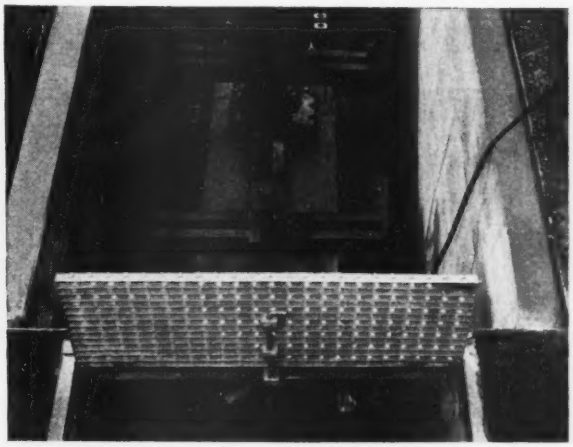
Compactness of G-E network units permits minimum vault depth (7 feet to roof slab) for lower installation cost.

It pays to start a network. Although the change from a radial to a network system means substantial initial expense, future increases in capacity require less investment with a network system. With a growing load, the sooner the network system is started, the lower the ultimate cost. Why not investigate the advantages for your system?

For help in solving your network problems, and for complete information on the many advantages of G-E standardized network units, get in touch with your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5024, General Electric Company, Section 431-201, Schenectady 5, N. Y.



ALMOST IN PLACE and with minimum inconvenience, even in a congested downtown area. Note the G-E submersible automatic network protector on the low-voltage end of the transformer.



CENTERING UNIT in vault prior to cabling. Convenient location of cable terminals on G-E units makes minimum size vaults practical—simplifies connections for fast installation.

You can put your confidence in—

GENERAL ELECTRIC

Mobile Unit Cuts Costs of Outage or Changeover

RAY F. EGGERS, Line Supt

WAYNE MILLER, Transportation Supt, Sacramento Municipal Utility District, Sacramento, Calif.

Three-phase transformer bank failures or changeouts are handled in Sacramento Municipal Utility District with a mobile unit that may be placed in emergency operation in star or delta secondaries on short notice. Quick restoration of service after outages and elimination of high-cost peak changeouts where customer service must be maintained has more than justified its cost of $861.22 for labor and $1,418.65 for materials excluding transformers.

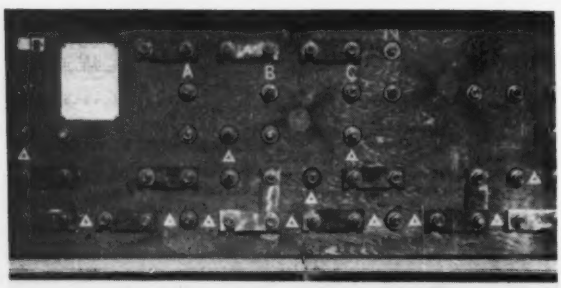
Unit consists of three 100-kva, 2,400-120/240-v transformers, a secondary changeover panel for star or delta connections, 100-amp primary cutouts, and primary and secondary lead cables. All equipment is carried on a 4-wheel trailer of 2-ton capacity. Transformers are suspended from a steel frame of 8x3x⅜-in. channel, 120 in. long and 46 in. wide mounted on trailer.

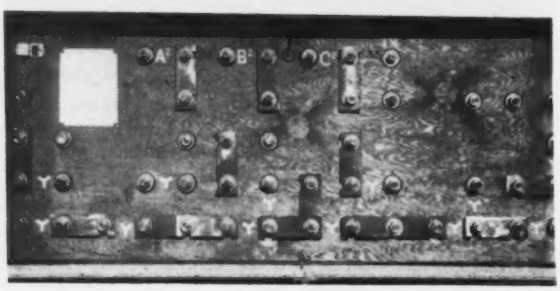
All equipment is completely enclosed on the sides by a body of 20-gage steel. Access to secondary changeover board and primary cutouts is provided by doors that may be closed and locked with unit energized. Bottom and top of body is protected by heavy wire mesh that also allows adequate air circulation.

Transformers with four-terminal secondaries are used to permit interchangeable star or delta secondary connections. These terminals are connected directly to individual binder post terminals at back of changeover panel by 4/0, neoprene-covered, stranded copper cable. Connectors of 2x3x¼-in. copper bus bar are directly fused to secondary cables.

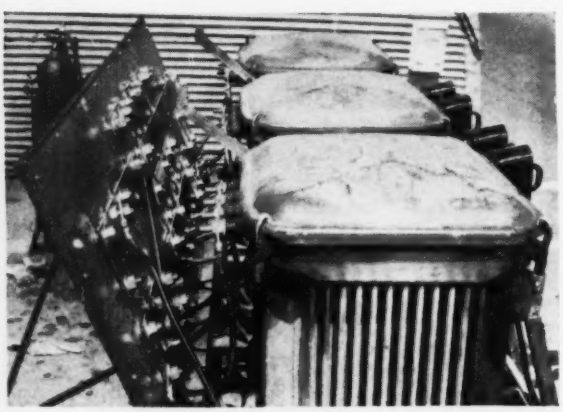
Changeover panel is 1-in., 5-ply marine plywood measuring 90x36 in. and set in 1¼x⅛-in. angle iron frame. Panel was treated with nine coats of glyptol varnish to

STAR OR DELTA secondaries are serviced with equal ease from three-phase transformer trailer. Unit is locked while energized





CHANGEOVER BOARD has delta (top) and star (bottom) symbols to aid in connecting secondaries. Star hook-up is made by covering star symbols with connecting links, delta symbols for delta hook-up

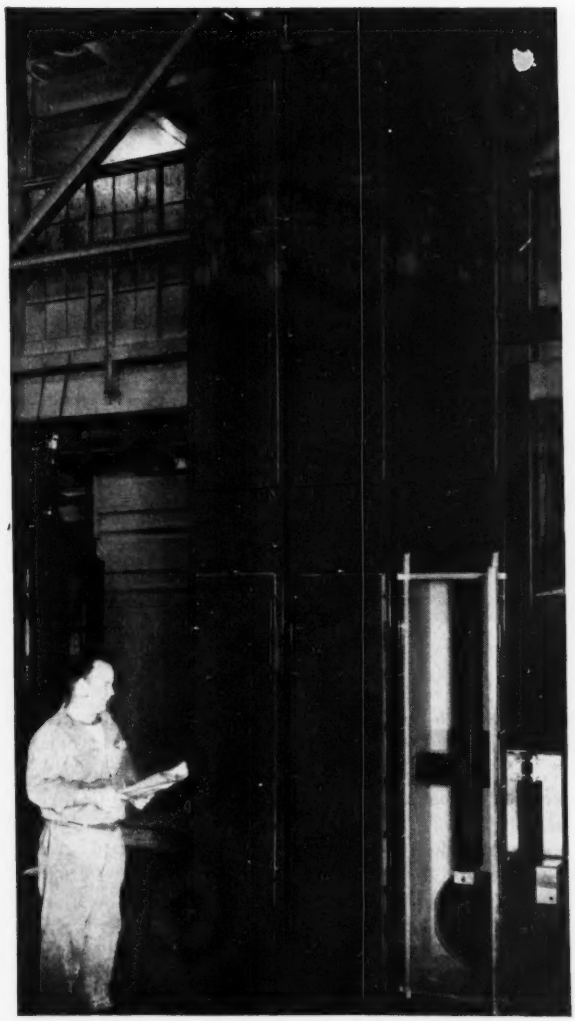


SECONDARY CONNECTIONS to changeover panel are 4/0, neoprene-covered, stranded copper cables with ends fused to short piece of busbar. Board was treated with nine coats of glyptol

FIRST TO SHIP 8-FOOT ISOLATED-PHASE BUS IN ASSEMBLED UNITS . . .

Installing a pre-assembled, 8-foot G-E bus section.

...NOW G.E. CAN SHIP ASSEMBLED BUS SECTIONS 16 FEET LONG



For years, factory assembled G.E. isolated phase bus has paid off in low installation costs. Crated 3-phase sections arrive ready to lift into place. Now, further savings can be realized by reducing the number of packages to be handled and the number of section interconnections to be made up because new manufacturing facilities permit fabrication of units *up to 16 feet long!* This means real savings in overall installed costs.

Some of the other proved design features of G.E. isolated phase bus which are retained in this new design include:

- Ease of inspection through hinged covers.
- Reduced number of insulation creepage surfaces without sacrifice of mechanical strength.
- Shipment of complete single-conductor assemblies where required.
- Easy facilities for checking and locating sheath grounds.

Your G.E. sales representative has complete information. Ask him for a copy of GEA-5460, a 28-page publication that will aid you in planning your buses, or write to General Electric Company, Schenectady 5, N.Y.

871-1

The new 16-foot G-E isolated phase bus section, ready to install.

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

You can put your confidence in—

GENERAL ELECTRIC

increase dielectric strength. Spaced on 6-in. centers horizontally and vertically to allow easy interchangeability of movable links are 48 holes for terminal binder posts. Micarta bushings inserted in holes with micarta washers at each end of binder posts provide adequate insulation.

Binder posts are 1-in. full-threaded copper stud bolts of varying lengths so suit bus bars and movable links. Standard brass washers at each end of posts are held in place by brass jam nuts. Copper bus bars at back of panel and movable links on front are 3 in. wide and ¼ in. thick.

Binder posts are arranged so that change from star to delta or reverse may be made in less than 5 min. Twelve star symbols and twelve delta symbols aid in making changes. It is necessary in making star hook-up, for example, merely to cover all star symbols with a link. Likewise, all delta symbols are covered in making a delta hook-up.

Secondary leads of 4/0 welding cable 60 ft long extend from top of unit through micarta tubes, which are held in place by 1½-in. pipe nipples set in structural flanges secured to trailer framework. Cable weight is such that two cables are provided for each lead to insure full-load capacity and still keep within reason the weight that must be sent up the pole. On reduced loads, only one set of leads is used; auxiliary leads are disconnected by transferring movable links in panel.

Leads are connected to overhead lines with jumper clamps and are supported on crossarm by 6-ft length of manila rope served onto cable 4 ft from upper end. Grounding lead consists of 20 ft of cable tied directly to the trailer frame and fitted with a ground clamp for attaching to ground rod or other suitable ground.

Primary leads extend up from opposite side of trailer in same manner as secondary leads. They are No. 4, 7-strand, 5-kv, neoprene-covered, shielded cable. Cutouts are mounted in unit with primary bus carried in micarta tubes where necessary. Primary connections are for star hook-up and neutral cable is not shielded. Jumper clamps on primary hot legs are equipped with 15-in. handles and neutral cable with a 6½-in. handle.

Lighting for unit consists of two 6-v dome lights and necessary running lights energized from towing vehicle. Supplemental lighting of 4-dome lights and red warning lights is energized from 120-v source after unit is in operation.

Hammer Boom Cuts Labor 60%

Time for digging holes in rock with an air hammer has been reduced 60% by Dayton Power and Light Co through use of a boom mounted on a swivel for moving the air hammer from place to place. This method saves the operator's energy required for lifting and moving the air hammer. Studies indicated that a large part of the energy used on this job was for handling the hammer.

To build this rig, a ladder swivel mount was taken from a street light maintenance truck, which was being retired. The ladder swivel was mounted on the air compressor truck. Some channel members were attached to it and a light weight crane made from a 1940 model aerial ladder was built and fitted to the swivel.

A compressed air driven winch provides vertical motion and the swivel mount provides horizontal motion for the hammer.

Modifications Improve Phasing-Out Voltmeter

BRUNO GIAMBI, Engineer, Electrical Construction Department, Overhead, Commonwealth Edison Company, Chicago

Addition of a second set of resistances and a button switch has increased usable range of primary phase-out voltmeter. The voltmeter, formerly adequate for primary lines, now has a zero to 500-v range also. It is now applicable for:

1. Determining whether a circuit is energized and at what voltage.

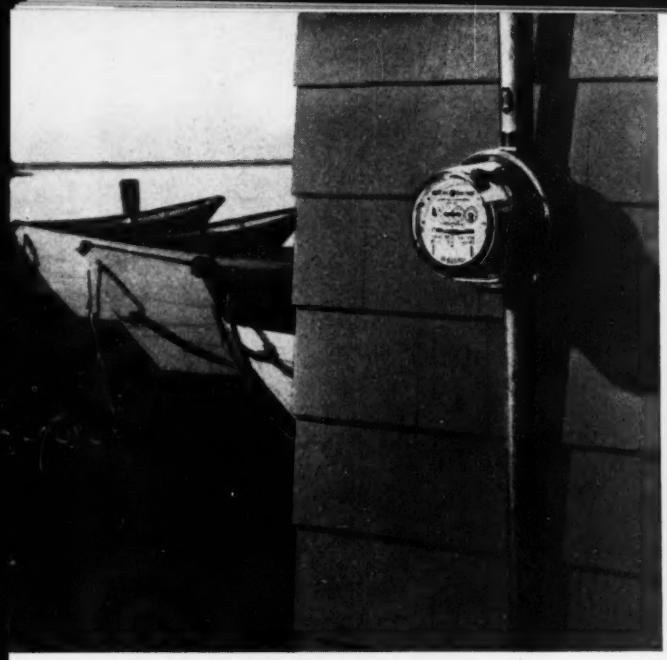
2. Measuring the difference in voltage at 4-kv circuit phase displacement ties.

3. Testing 470-v secondaries.

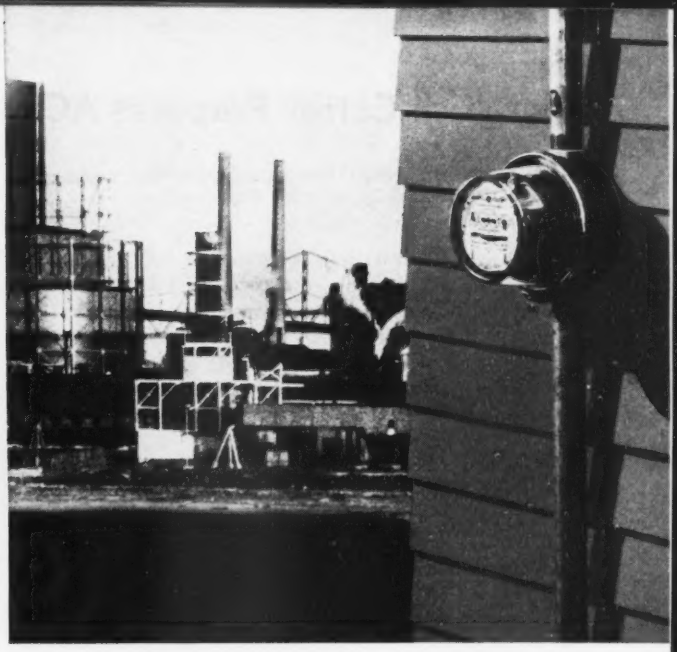
4. Testing for charged transformer cases.

Modification of the meter consists of a push-button switch which, when depressed, reduces the resistance in the meter circuit from five megohms to ½ megohm. With this arrangement, readings of zero to 500-v can be obtained with reasonable accuracy.

The modified voltmeter has reduced the number of tools carried in the company's line trucks. Formerly trucks were equipped with a 500- to 900-v and a 2.2- to 4.4-kv voltage detector. These have been replaced with the more accurate modified instrument.



In Salty Coastal Atmospheres . . .



In Corrosive Industrial Atmospheres . . .

Certified I-50 Meters Offer Dual Protection Against Corrosion—Both Inside and Outside

Field tests in coastal and industrial areas have proved that the General Electric certified I-50 meter offers outstanding protection against corrosion, both inside and outside. Such dual protection cuts costs normally expended for cleaning, painting, and general maintenance.

ALL EXPOSED SURFACES of both the socket-type and front-connected I-50 meters are made of materials designed to resist corrosion. For example, the front-connected type meter has an aluminum terminal cover, cover ring, bayonet clips, sealing bar, etc. The socket-type meter has a Textolite* base; its glass-cover rings and the socket sealing-rings are of stainless steel.

ALL INTERIOR PARTS of both the A- and S-type I-50's have been given special treatment to reduce corrosive action within the glass cover.

*Reg. Trademark of General Electric Company

BOTH OF THESE METERS adequately meet the "Class I General-purpose Finish" standards established by NEMA. In addition, tests and field experience in locations having exceptional corrosion hazards show that the S meter meets NEMA's "Class II Corrosion-resistant Finish" standards. The Textolite base and stainless-steel cover-ring combination is *unaffected by any materials* used for sockets or socket-sealing rings.

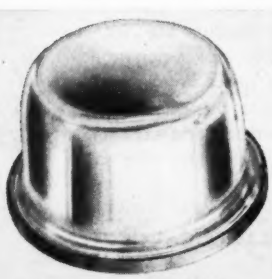
FOR MORE INFORMATION, call your G-E representative. Ask to see the new color motion picture "Accent on Accuracy." General Electric, Schenectady 5, N. Y.

601-97

You can put your confidence in—

GENERAL ELECTRIC

ONLY CORROSION-RESISTANT MATERIALS—glass, textolite, and stainless steel—are used for all exposed surfaces of certified socket-type meters. And all G-E sockets are sold with stainless-steel sealing-rings—an exclusive General Electric feature.



STAINLESS STEEL COVER RING

TEXTOLITE BASE PLATE

STAINLESS STEEL SOCKET SEALING RING

Hot-stick Cutter Prepares ACSR Conductor

ARTHUR PECK, District Distribution Supervisor, Indiana & Michigan Electric Co, Hartford City, Indiana

A tube cutter has been modified for hot-stick use to enable cutting aluminum strands without damage to the steel core while the conductor is energized at 12 kv. A tool was chosen with rollers above the cutter so that it can be hung on the conductor with a grip-all stick. The cutter can be tightened with a switch stick and rotated around the conductor in the same direction as the stranding in the conductor.

Prior to cutting the aluminum strand, a hot-line clamp can be installed just clear of the cutter and held with a grip-all stick to keep the conductor rigid while strands are being cut. This device permits cutting aluminum strands neatly and without burrs, facilitating the installation of a splicing sleeve.

Damage to the steel core of No. 4 conductors is avoided by pinning half of a No. 2 compression sleeve on the screw at predetermined distance from the tip. For No. 2 conductor, a 0.05-in. spacer is placed on the screw as shown. For larger conductors, additonal spacers appropriate to the size conductor can be applied. To tighten and rotate the cutter with a switch stick, a ring from a discarded hot-line clamp was pinned to the cutter.

HOT-LINE CLAMP holds ACSR conductor while strand cutter is tightened and rotated by switch stick, thus cutting aluminum neatly

Washing Machine Cleans Rubber Goods Quickly

W. J. FELISS, Foreman, Tool Service, Electrical Construction Department, Shops and Tool Service, Commonwealth Edison Company, Chicago

Washing time for rubber protective equipment has been greatly reduced by the Commonwealth Edison Company through the use of a commercial clothes washer. The machine used is a reversing tumbler type, of 35-lb capacity. Approximately 70 gloves can be washed at a time. Other protective equipment is washed on the basis of 35 lb to one washing operation.

WASHING GLOVES and rubber goods requires two to four hours in a detergent and water solution at a temperature of 120 F. The rinsing operation requires five to ten minutes

The washing is done in water at about 120F with a measured amount of detergent. Washing time for each batch is between 2 to 4 hours, depending on the condition of the equipment. When the washing operation is completed, the washing water is drained out and clean water is admitted to the washer.

The rinsing operation takes from 5 to 10 minutes. After the equipment is rinsed, it is taken out of the machine and placed on a peg rack to air dry. Following drying, rubber goods are tested for defects.

Washing requirements are 100 to 125 pairs of rubber gloves per month. In addition, line hose, hoods, rubber blankets and other protective equipment, used by construction crews, are also laundered periodically with satisfactory results.

DELTA-STAR'S time-tested, single side-break PMB-236 SWITCHES

where cost and space are considerations

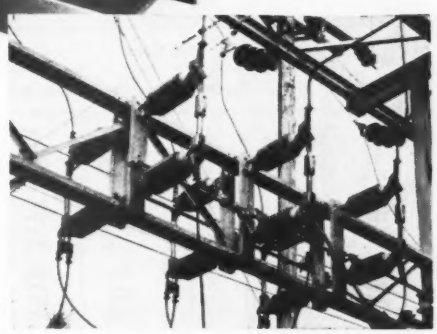
these switches give you the most for your dollar investment. Many engineers prefer this type because of its versatility, compactness and ease of operation. There is a type for every outdoor application—whether upright, inverted or vertically mounted.

6

OUTSTANDING FEATURES

1. Multi-finger, high pressure, silver inlaid button type contacts.
2. Heavy copper tubular blade with knee-break contact section of hard drawn copper.
3. Fully enclosed knee-break blade mechanism.
4. Rotating terminal. Free swinging terminal at hinge relieves strain on cable as insulator rotates.
5. Greaseless non-rusting type ball bearings insure free operation. Radial and thrust loads are fully supported.
6. Threadless adjustable operating mechanism parts with self-piercing set screws eliminate drifting once final adjustment is made.

Available in all standard ratings: 7.5 to 161 KV inclusive; 400, 600 and 1200 amperes.



WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

Ampere Factors Aid in Calculations of Three-phase Motor Currents

Tables facilitate calculation of accurate input current for three-phase motors at full load and for standard voltages

Table 1—Ampere Factors for Three-phase Induction Motors

Motor Hp	Voltage					
	208	220	440	550	2300	4160
30	62.1	58.8	29.4	23.5		
40	82.8	78.3	39.2	31.3		
50	103.6	97.9	49.0	39.2	9.4	
60	124.2	117.5	58.8	47.0	11.2	
75	155.4	146.9	73.5	58.8	14.0	
100	207.1	195.8	97.9	78.3	18.7	10.4
125	258.9	244.8	122.4	97.9	23.4	12.9
150	310.8	293.8	146.9	117.5	28.1	15.5
200	414.1	391.6	195.8	156.7	37.5	20.7
250			244.8	195.8	46.8	25.9
300			293.8	235.0	56.2	31.1
350			342.8	274.2	65.6	36.3
400			391.6	313.3	74.9	41.4
450			440.6	352.5	84.3	46.6
500			489.6	391.6	93.7	51.8
600			587.6	469.9	112.4	62.1
700			685.5	548.2	131.1	72.5
800			783.2	626.5	149.8	82.8
900			881.1	705.0	168.6	93.2
1000			979	783.3	187.3	103.5
1250					234.1	129.4
1500					280.9	155.3
1750					327.7	181.2
2000					374.6	207.0
2250					421.4	232.9
2500					468.2	258.8
3000					561.9	310.5
3500					655.5	362.3

Both tables are based on the formula

$$\text{Amperes} = \frac{\text{Hp} \times 746}{1.73 \times \text{Volts} \times \text{Eff} \times \text{PF}}$$

For a given horsepower and voltage, the items—hp, 746, 1.73 and volts—in this formula become a constant and are resolved into a single ampere factor. Dividing the ampere factor by the full-load motor efficiency (and full-load motor power factor in the case of induction motors), expressed as a decimal ratio, gives the motor full-load current.

Example . . . What are the full-load amperes of a 500 hp, 2,300 v induction motor having a full-load efficiency of 93.3% and full-load power factor of 90%?

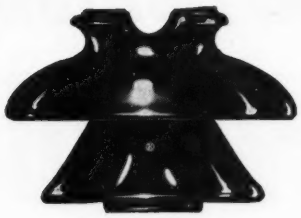
Solution. Efficiency and power factor expressed as decimals are: 0.933 and 0.90, respectively. Ampere factor from Table 1 is 93.7. Then by calculation:

$$\text{Full-load Amperes} = \frac{93.7}{0.933 \times 0.90} = 111.6$$

Tables published by courtesy of Electric Machinery Mfg Co, Minneapolis, Minnesota

Table 2—Ampere Factors for Three-phase Synchronous Motors

Motor Hp	208 Volts		220 Volts		440 Volts		550 Volts		2300 Volts		4160 Volts	
	100% P. F.	80% P. F.	100% P. F.	80% P. F.	100% P. F.	80% P. F.	100% P. F.	80% P. F.	100% P. F.	80% P. F.	100% P. F.	80% P. F.
50	104	129	97.9	122	48.9	61.2	39.2	48.9	9.4	11.7	5.2	6.5
60	124	155	117	146	58.7	73.4	47.0	58.7	11.2	14.0	6.2	7.8
75	155	194	147	183	73.4	91.8	58.7	73.4	14.1	17.6	7.8	9.7
100	207	259	196	245	97.9	122	78.3	97.9	18.7	23.4	10.4	13.0
125	259	324	245	306	122	153	97.9	122	23.4	29.2	13.0	16.2
150	311	388	294	367	147	183	117	147	28.1	35.1	15.6	19.4
175	362	453	343	428	171	214	137	171	32.8	40.9	18.1	22.7
200	414	518	392	489	196	245	156	196	37.4	46.8	20.7	25.9
225	466	583	440	550	220	275	176	220	42.1	52.6	23.3	29.1
250	518	648	489	611	245	306	196	244	46.8	58.5	25.9	32.4
300	622	777	587	734	293	367	235	293	56.2	70.2	31.1	38.8
350	725	906	685	856	342	428	274	342	65.5	81.9	36.2	45.3
400	828	1036	783	978	391	489	313	391	74.9	93.6	41.4	51.8
450	932	1165	881	1101	440	551	352	440	84.3	105	46.6	58.2
500	1035	1294	979	1223	489	612	392	489	93.6	117	51.8	64.7
600	1242	1554	1174	1468	587	734	469	587	112	140	62.1	77.7
700	1450	1812	1370	1713	685	857	548	685	131	164	71.6	90.6
800	1656	2072	1566	1957	783	979	626	783	150	187	82.8	103
900	1863	2330	1762	2202	881	1101	704	881	168	210	93.1	116
1000	2072	2588	1957	2450	979	1224	783	979	187	234	103.5	130
1250	2588	3236	2446	3058	1224	1530	979	1224	234	292	129.5	161.8
1500					1468	1836	1175	1468	281	351	155.3	194.2
1750					1710	2142	1371	1710	328	409	181.2	227
2000					1956	2449	1565	1956	374	468	207.0	259
2250					2200	2753	1762	2200	421	526	233	291
2500					2445	3060	1958	2445	468	585	259	324
3000					2936	3672	2350	2936	562	702	311	388
3500					3425	4284	2740	3425	655	819	362	453



Sound Design

. . . WITH 38 YEARS ON THIS LINE TO PROVE IT!

O-B pintype insulators were installed on this 13.2-kv line 38 years ago. It's not too easy a spot -- contamination has become worse than average, terrain is mountainous, average storm frequency over 36. The insulation shows no apparent deterioration, and replacements due to all causes have been negligible.

Performance such as this can mean only one thing -- basically sound design and faithful interpretation of that design into an equally sound product.

Where reliability is the first consideration, you can place absolute confidence in the service background and manufacturing ability behind O-B pintype insulators.

Ohio Brass

MANSFIELD OHIO, U.S.A.

IN CANADA: CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4392-H

Phelps Dodge Rectangular

SAVE SPACE—IMPROVE

The application of thin film insulation to rectangular or square wire—pioneered by Phelps Dodge —permits . . .
✓ BETTER SPACE FACTOR
✓ SMALLER COILS—LESS IRON
✓ BETTER FORMING AND WINDING
✓ OVER-ALL SAVINGS IN COST

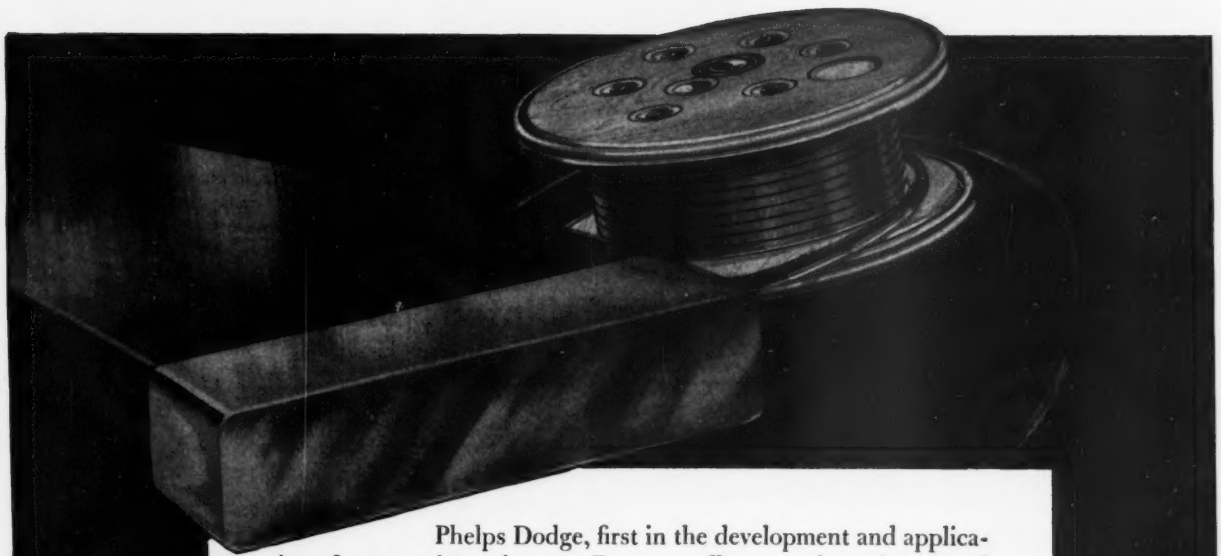
"It takes the best

PHELPS DODGE COPPER PRODUCTS

CORPORATION

or Square Formvar Helps You

DESIGN AND EFFICIENCY



Phelps Dodge, first in the development and application of rectangular and square Formvar, offers a product, time-tested for applications where space is at a premium and where the outstanding abrasion, chemical and forming properties of this *thin film* magnet wire can be utilized. When used under fabric (glass and cotton), it improves dielectric and moisture resistance, and makes possible over-all savings in the insulation system. Available in volume over a complete range of sizes.

Any time magnet wire is your problem, Phelps Dodge has the quickest, easiest answer!

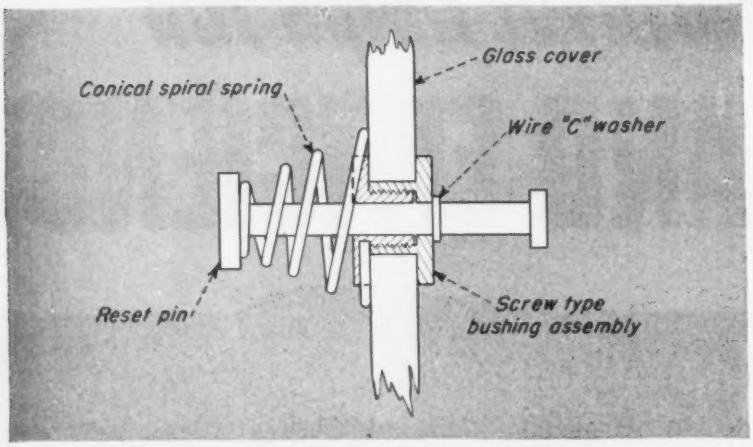
to make the best!"

INCA MANUFACTURING DIVISION

FORT WAYNE, INDIANA

Target Reset Springs Eliminate Relay Troubles

E. J. EMMERLING, Senior Operating Engineer, The Cincinnati Gas and Electric Co, Cincinnati, Ohio



CONICAL SPRING of brass spring wire 0.031-in. diameter, 4½ turns, 9/16-in. long, 5/8-in. base diameter, 7/16-in. top diameter and one-lb thrust at half deflection provides positive action to target reset pin, overcoming corrosion problem of the target reset pins

On the Cincinnati Gas and Electric system there are about 700 relays of a type that have given some trouble due to corrosion of the target reset pins. If the pin is pushed in it may not reset and the target will not latch up when the relay operates.

Operator Wilbur West suggested a spring to be screwed over the reset button, as shown in the sketch. The small end is bent to retain the spring. The cover does not have to be removed to make the installation. A local spring manufacturer made the springs for this application.

Questionnaire Collects Data on TV Interference

R. W. BAKER, Georgia Power Co, Atlanta, Ga.

Utilities can solve their television interference problems by using suitable equipment standards and proper construction design practices on power lines. But such standards must be based on experience, adequacy and economy. To gain such data, Georgia Power Co prepared the questionnaire shown. The interference data so far accumulated can be summarized in the following classifications:

	Cases	Line Voltage
A. Not from Electric Power System		
1. Radio Frequency Interference	1	——
2. Commutator Arcs	3	——
3. Thermostat Control	1	——
B. From Electric Power System		
1. Faulted Equipment	2	4kv
2. Bad Joints in Line	1	38kv
	2	44kv
3. Probable Loose Tie Wire or Corona Type Discharge	1	44kv
4. Cause Undetermined at This Time	1	11kv
	1	44kv
	1	66kv
5. Very Weak Signal Strength	2	44kv

For those reports classified under "B" the distance from the transmitter to the receiver was between 50 and 90 miles. The reception without interference was reported good in two cases, fair in five cases and poor in four cases. The effect of the interference on the picture was two distinct bands in three cases, uniform distribution in seven cases and a horizontal section torn out in one case.

Two cases listed at "B-5" have very poor reception because of moun-

REPORT OF TELEVISION INTERFERENCE COMPLAINT
WITH ATTACHED SKETCH (SEE NOTES)

Date_____

1. Name of Set Owner_____

2. Location: Street_____Town_____

3. Set: Make_____Year Made 19____Antenna: Inside: In Set Attached
Outside: Simple Multiple

4. Quality of picture when interference is not present. See Notes.
Clear Slight Snow Much Snow and Ignition Streaks

5. Location of Station viewed for answer of Item 4._____Call Letters_____

6. Distance--Station to Set____Airline Miles, Over: Flat Ground Hills Mountains

7. Description of picture when interference is present: (Sketch Pattern of Interference Here)
(a) Picture still on the screen. Yes No
(b) Sections tear out horizontally. Yes No
(c) Picture moves vertically when interference
comes on. No movement Picture jumps one
or two times and stops Keeps moving
(d) Remarks: (Include hours when the interference
is on and the weather conditions prevailing.)

8. Description of change in sound when the interference comes on._____

9. Source of interference._____

10. Corrective measures taken._____

11. Results accomplished._____

NOTES: WHEN THE SOURCE OF INTERFERENCE MAY BE FROM OUR SYSTEM, ATTACH A ROUGH PENCIL SKETCH SHOWING THE SET'S RELATIVE POSITION WITH RESPECT TO OUR LINES. SHOW LINE VOLTS AND APPROXIMATE DISTANCES. If space is not available on this form for full explanation, attach additional sheet. Item No. 4 is expected to indicate the signal strength reaching the television set. Clear picture means the blacks and grays are solid without gray dots and splotches. Slight snow means the blacks and grays in the picture have irregular dots and the splotches of gray or white which change position and size from instant to instant. Much snow means white and larger dots and splotches as above. Ignition streaks mean very white dots with trailing streaks of white or gray or broken horizontal lines of whites, blacks or gray caused by automobile ignition or similar electrical discharges when that type of interference is present.

Comparison Proves You Can Reduce Regulation Costs

Check These Figures
4160 Volt Y Substation Load of 3000 Kva, Two 200 Amp Radial Feeders
Cost of ±10% Regulation
Single-phase Feeder Regulation with six 200 ampere Station Regulators
$15,492
3-phase Feeder Regulation with two 150 Kva Station Regulators
$14,304
3-phase Bus Regulation with 3-phase Station Regulator
$9775
3-phase Bus Regulation with LRC on 3000 Kva Step-down Transformers
$8362
Single-phase Feeder Regulation with six 200 amp Distribution Regulators
$7356
ALLIS-CHALMERS
5/8% STEP
VOLTAGE REGULATORS

This Single Example Shows How You Save At Least

$1006.00

Over Previous Lowest Cost Equipment

The economy story above is just one reason why it will pay you to re-evaluate voltage regulation for your system. Changes in system economics brought about by Allis-Chalmers distribution regulators may add up to better regulation and lower costs.

In many cases you can now bring the advantages of individual phase regulation to every feeder in a system. Both utility and consumer benefit. You get ± 1 volt accuracy, 20% range of regulation. You can increase revenue — and profits.

Get High Quality Regulation

Allis-Chalmers distribution regulators bring you all the advantages of 20 years of regulator progress. You can get more facts on these low-cost, reliable units — plus a set of six cost comparison charts to help analyze your system — by calling your nearby A-C district office or writing Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4044

ALLIS-CHALMERS

Originators of 5/8% Step Regulation

tains between the transmitter and receiver. The very minimum interference radiation was estimated to be more than 10% of the signal strength available.

The present television receiver has partial immunity from strong interferences while it is receiving a strong signal. Manufacturers indicate that their sets will receive acceptable pictures from 50 to 70 miles. At these distances, they indicate, an interference of 1% of signal strength is noticeable; 10% is intolerable. Thus, we must establish a maximum strength of radiated interference that can be tolerated for the signal strength in the area and then evaluate performance of properly maintained lines and equipment with respect to their radiation of an interference level below this maximum.

Data and experience indicate that the company's existing test equipment is inadequate for locating and measuring television interference sources. No pattern of standard corrective measures has been found that seems applicable to a group of cases. More field experience must be acquired before definite trends can be established.

Edison Electric Institute has appointed a subcommittee on television interference. This is expected to establish the scope of television problems. A complete report of this subcommittee cannot be expected to furnish detailed field experience or all the answers for each specific problem; therefore, each company must accumulate its experience information on each phase. Interchange of all such information among members of this Exchange is earnestly recommended.

Adapted from recent Southeastern Electric Exchange paper.

STORING HOT STICKS in a special box has increased the number of sticks easily carried on line trucks. Ten 10-ft sticks can be carried in the 131-in. box. Cover is 107 in. long.

Hot Stick Box Provides Storage Space

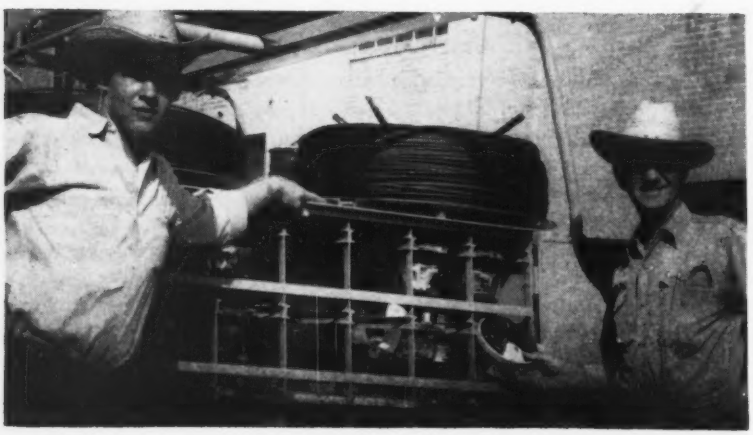
W. T. DONOVAN, General Supervisor of lines, Pennsylvania Power Co, New Castle, Pa.

To provide adequate truck storage space for a sufficient quantity of hot line sticks for use on the 12.5-kv distribution system Pennsylvania Power Co has added a box to the exterior of six trucks. The box not only prevents abuse and provides easy access to the sticks but also harmonizes with the truck body lines. In addition, the box permits drying of sticks by leaving the compartment door open when the truck is in the garage.

Made of sheet steel, the box measures 131 in. long, 11 13/16 in. high and 6¾ in. deep; it has a 107-in. door. The rear 24-in. section is of heavier construction to withstand pole impacts, which occur when setting poles with the truck. After fabricating in the shop, the box is bolted to the truck's side.

On the inside of the box are fastened double "U", hesitation type, rack hangers lined with a rubber material. These racks hold 10 sticks, the longest of which is 10 ft.

A smaller box, 106 in. long with a full length door, for 8-ft sticks is used on three-man service trucks.



Channel Iron Slots Hold Meters

Less breakage of canopies and bases, added convenience and greater storage capacity have resulted from a new truck bin developed by the Fort Worth Meter Department of Texas Electric Service Co. Meters slip into channel iron slots, which hold them firmly in place.

The bin is carried between the truck sides and faces the tail end. It is built of 16-gage sheet metal, 1- x ⅞-in. steel bars and 1¼- x ½- x ⅛-in. channels.

Meet A. A. Johnson, Manager of Westinghouse Electric Utility Engineering, who will describe some important developments on . . .

Keeping generating capacity ahead of your growing loads

Al Johnson, over his years with Westinghouse, has covered almost every possible phase of electric utility engineering. His present position reflects his ability to deal authoritatively with utility problems. He and other members of the Westinghouse team, shown on the following pages, combine their practical knowledge to give you some convincing data.

"A giant stride is being made at our Steam Division to meet the need for more generating capacity. Ray Timmons, Division Manager, gives a brief progress report . . ."

YOU CAN BE **SURE**...IF IT'S

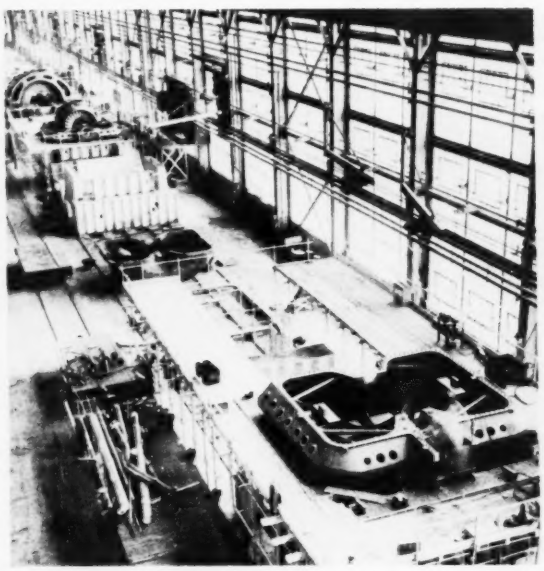
Tremendous expansion at Steam Division will boost turbine output

With the reactivation of a huge wartime plant and construction of new facilities, we are making a major step toward providing the needed capacity for America's generating plants. Four turbines are now being built on this giant erection floor. When the new additions are in full production, our yearly turbine capacity will be 4½ million kw. With me here is the special planning staff of top level managers, created to expedite this vast expansion . . . "Monty" Mauntel, Sales Manager; George Richardson, Manufacturing Manager; John Carlson, Engineering Manager. Total cost of this expansion will be $32 million, including a six million dollar outlay for the new development laboratory shown on the last page of this insert.

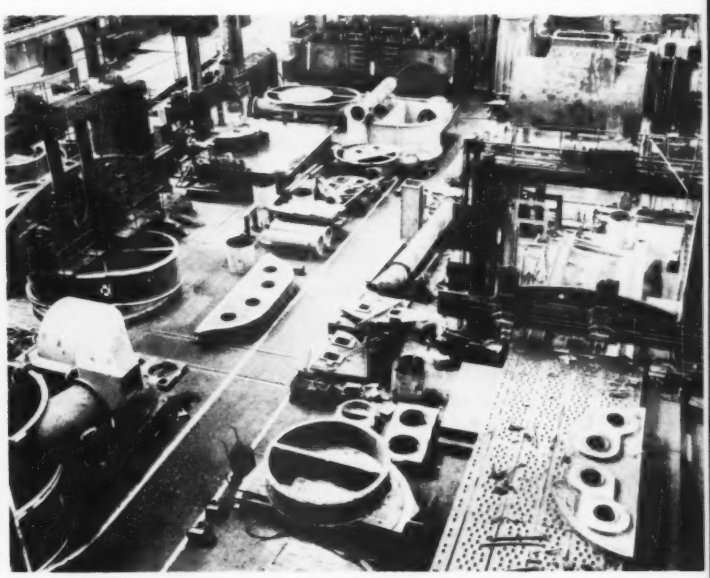
A cordial invitation to you

If you are in the Philadelphia vicinity and would like to visit our new plant, get in touch with me. I'll be happy to show you these new facilities.

J-50556



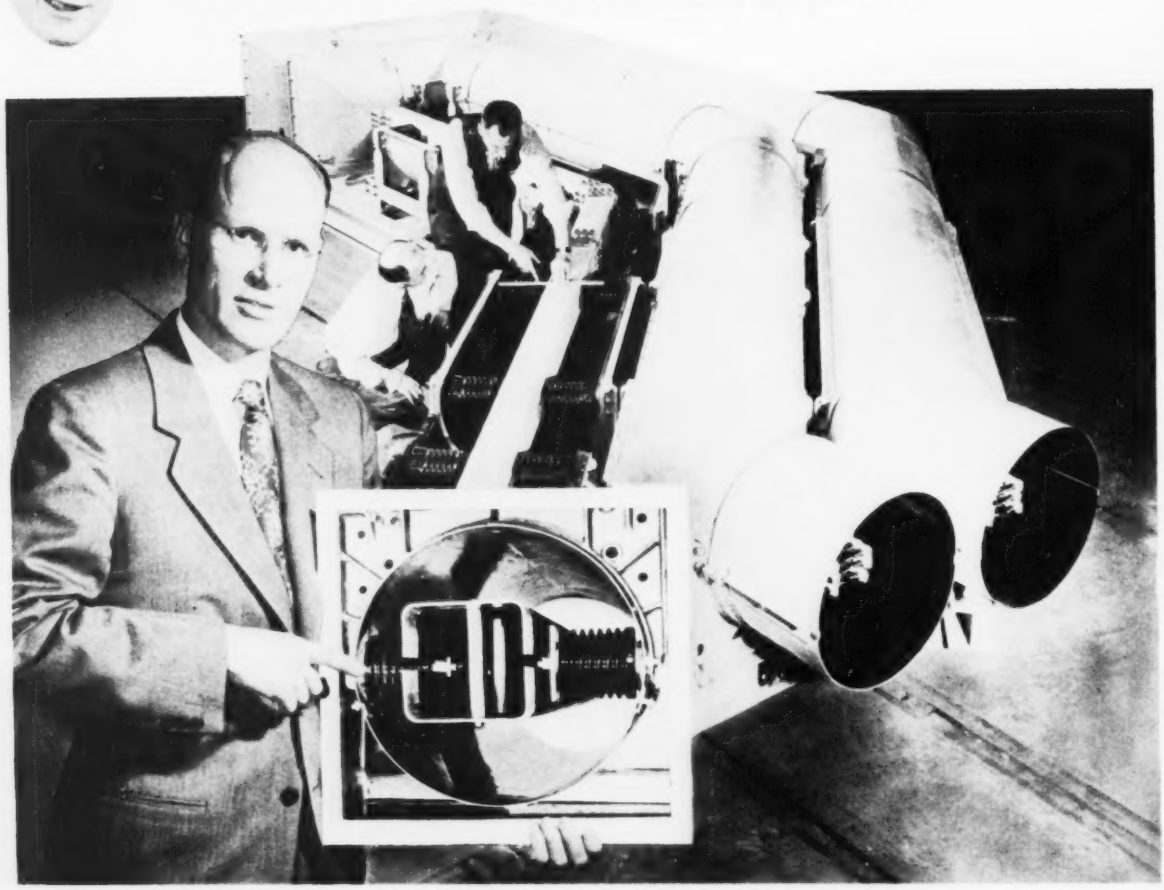
Eight 250,000-kw units tested all at once! These new test stands will handle eight 250,000-kw turbines all at once . . . or up to 20 smaller ones. The stands are adaptable to any anticipated unit size. This is farsighted planning to meet tomorrow's needs for additional generating capacity.



Condenser production to be tripled! Part of the new facilities will go for manufacture of big steam condensers. Production of condensers, feed-water heaters and evaporators will be tripled! Westinghouse planned for a balanced expansion of generating and auxiliary equipment.

Westinghouse

"The high voltage and current ratings in new power stations make generator connections a critical problem: W. C. Fulton discusses a good insurance policy . . ."*



The modern, safer bus construction for high-capacity generating plants

To provide better system protection, greater safety and greatly reduced maintenance, Westinghouse now offers a superior *isolated phase bus.* Individual enclosures around each conductor positively restrict insulation stresses to those between a single phase and ground.

The dust-tight and weatherproof enclosures practically eliminate periodic inspection and maintenance and they permit installations outdoors and in damp locations. The Westinghouse design provides increased reliability through the use of a minimum number of insulators having high mechanical strength.

Isolated phase bus provides maximum compactness in high-current generator leads as compared to the unwieldly construction of multiple cables and their associated ducts. Factory-designed and assembled units save you design expense and time.

Backed by heavy power experience

Our experience in applying switchgear with generators and transformers assures complete coordination of Westinghouse Isolated Phase Bus with the equipment it connects. The adequacy of this design has been proved in the laboratory and demonstrated in numerous successful installations.

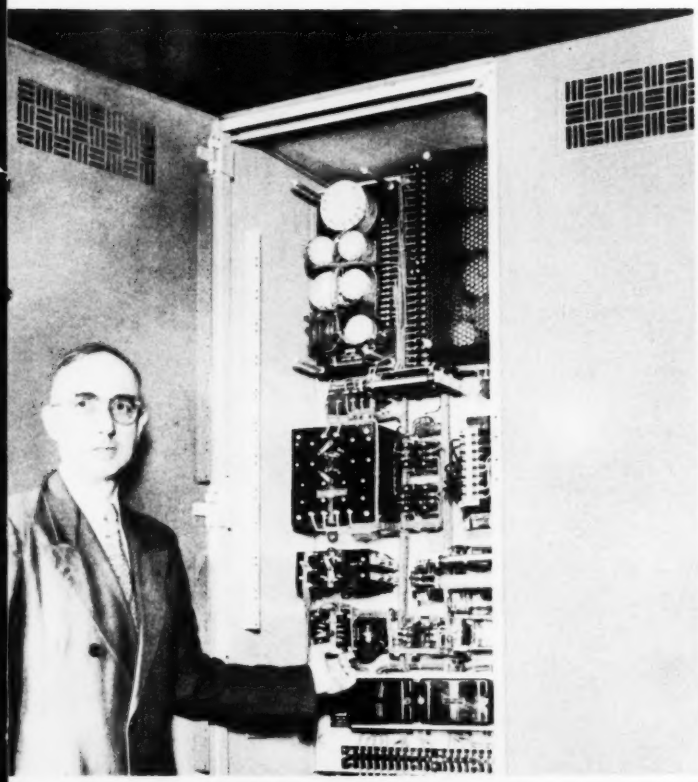
When you are building or expanding generating plants or substations, consider the greater safety and engineering soundness of Westinghouse Isolated Phase Bus. Write now for complete information.

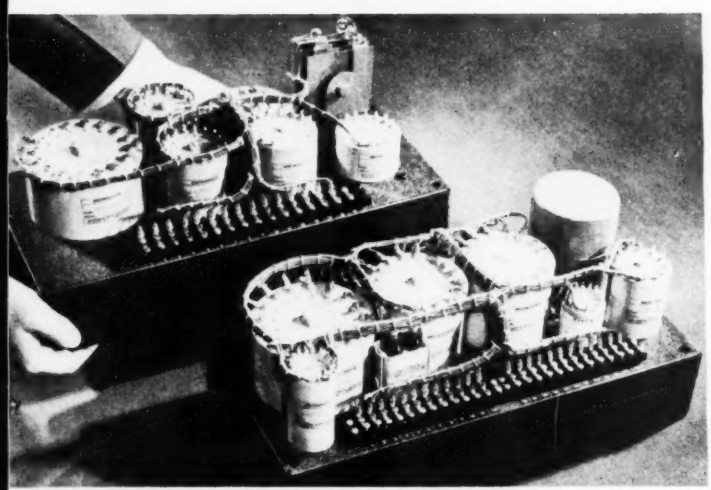
*Manager, Station-Type Cubicle Switchgear Engineering

J-60828

YOU CAN BE **SURE**... IF IT'S

"C. E. Valentine, Manager, Generator Voltage Regulator Engineering, discusses an important new development."





Typical magnetic amplifier assemblies. Chassis at left, above, is an underexcitation limit unit; right is a two-stage input Magamp unit with reference circuit and associated apparatus. The Magamp reactors are hermetically-sealed, as shown, for protection against atmospheric conditions.

Magamps: another great advance in generator regulation

Another great advance in generator voltage control systems is now going into switchgear cubicles—the Westinghouse Magamp. This new regulator and excitation system has undergone exhaustive and highly successful tests with a 50,000-kw turbine-generator. Production units are already in operation on utility systems.

Each successive step in the development of regulator and excitation systems has offered one or more of these advantages over its predecessor—improved reliability . . . reduced maintenance . . . improved performance.

Magamp is a new, fast-acting system which meets *all* of these requirements. Its function is the same as that of preceding generator voltage regulators—that is to control the exciter and hence the generator voltage. However, Magamp has these advantages: it is faster acting, requires a small power signal and has extremely attractive maintenance characteristics.

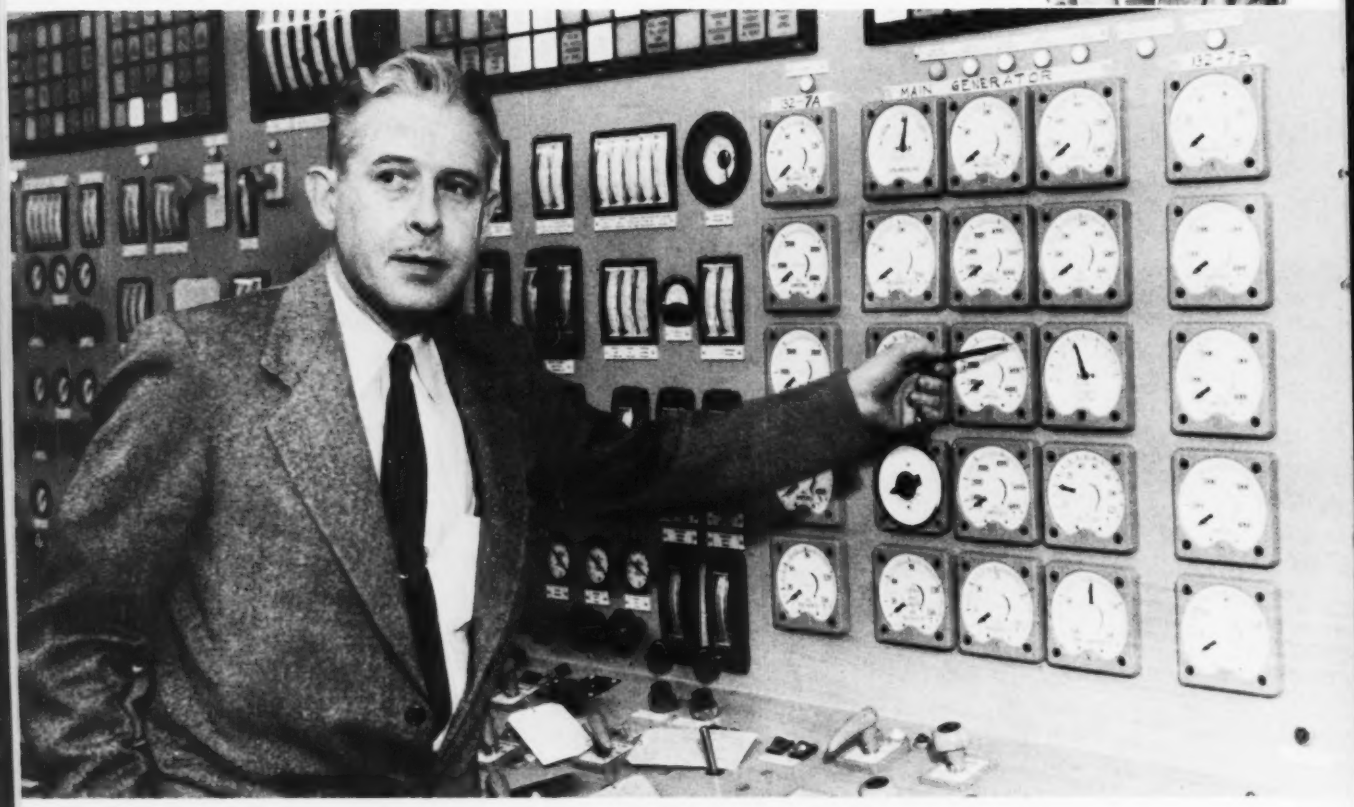
There are no moving parts in the regulating and limiting components—nothing to wear out. A further advantage is the fact that the power supply in the Magamp system is a motor-driven a-c generator with a permanent magnet field—it has no slip rings, no commutator, no brushes.

All Magamp Regulator components are assembled in a standard, low-voltage, metal-enclosed switchgear cubicle adjacent to exciter field rheostat and field breaker cubicles. The entire assembly is factory adjusted and tested . . . shipped ready for installation. Write us for more information on this significant development.

J-60829

Westinghouse

"Modern control stations are extremely important to greater generating capacity. Doug Young, Manager, Instrument Engineering, tells how modern instruments help make them possible."



How to develop more effective control stations in your power plant

Notice the electrical instruments in this control station, now being installed in a power plant. They're the super-readable type K-24 and they have helped make this control station considerably more efficient.

Because these instruments are so compact and readable, the designer was able to group all the electrical control functions for a turbine-generator in this one small area. Note that the steam functions are at the left on the same board. With this compact, efficient setup, *one man completely controls* one turbine-generator from the coal pile to the main busses.

You can read K-24's quickly and accurately from distances up to 20 feet or from angles as great as 65°. In some control stations, this permits the designer to mount the instruments high on a board instead of spreading them out lengthwise. This also makes for compactness. The great distance-visibility permits one man to see more instruments from one place. Both factors contribute to more centralized, more effective control.

The K-24 was designed after an intensive study of optical principles. Shadows are eliminated by a unique dial design. The effect of glare and parallax has been virtually eliminated.

The K-24 is one item in the complete Westinghouse line of outstanding electrical measuring instruments. Write now for CS 43-200 and B-4696 for more information. J-40449

YOU CAN BE **SURE**...IF IT'S

"Let's discuss the steps in meeting the responsibility of powerhouse motor selection for expanded generating plant auxiliaries."

How powerhouse motors are engineered to meet your generating conditions

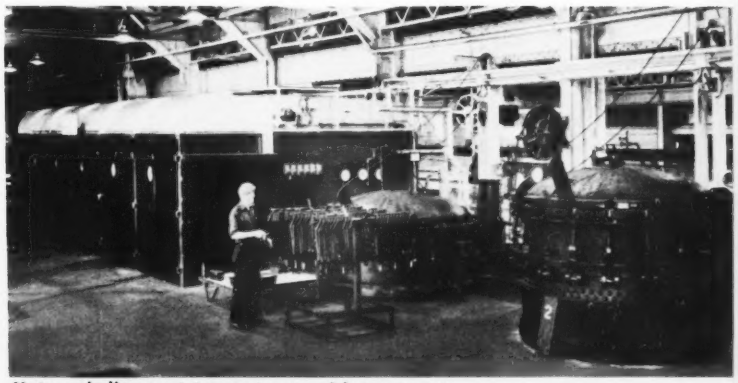
As bigger generating units are specified, new demands are made on powerhouse auxiliary operation. The selection of Westinghouse Powerhouse Motors to meet these changing conditions is given careful consideration.

Each motor in the complete powerhouse line, ranging from 1 to 3,000 hp, is specially built to the requirements of the individual generating station. Westinghouse Engineers, analyzing these requirements, write a special order outlining the design and construction details needed for every motor. As each motor is built, the component parts are tested for highest quality workmanship.

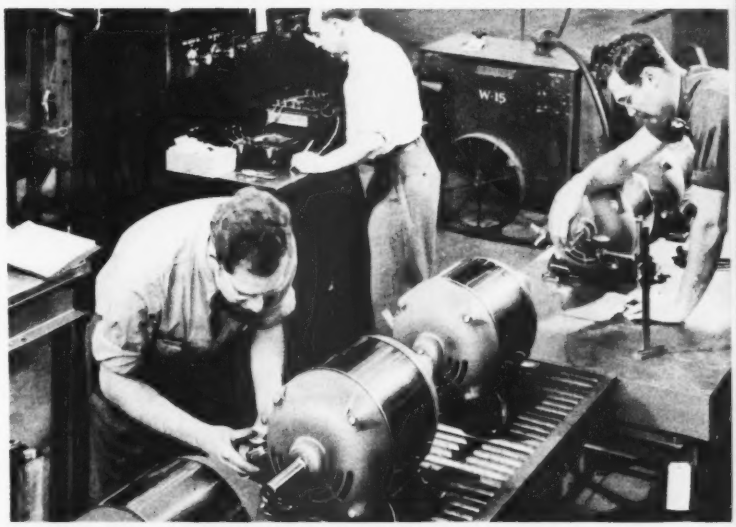
Full motor protection results from two extra dip-and-bake treatments specified for the windings of all powerhouse motors except those totally enclosed. The special "thermoset" varnish used gives a hard, dirt and grease-repelling finish to stand up to the high heat, moisture and fly-ash conditions of the powerhouse.

After assembly, each powerhouse motor is given a complete operating test and inspection by the Quality Control Department.

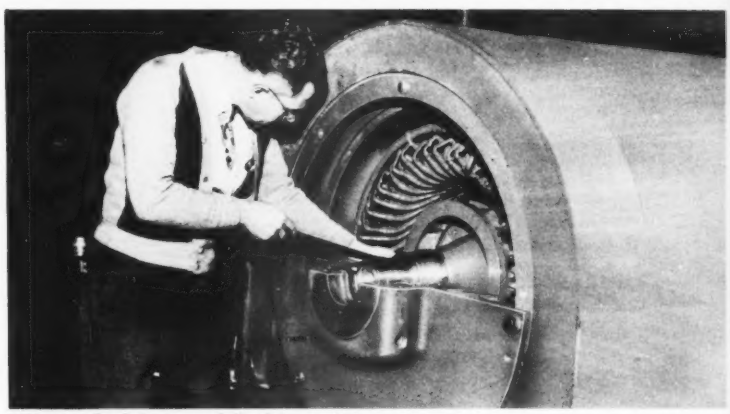
In this manner, each Westinghouse Motor is specially built for a particular powerhouse auxiliary, and thoroughly checked to assure years of continuous, efficient performance. Write for Bulletins B-2249 and B-4731.



Motor windings get two extra varnish treatments



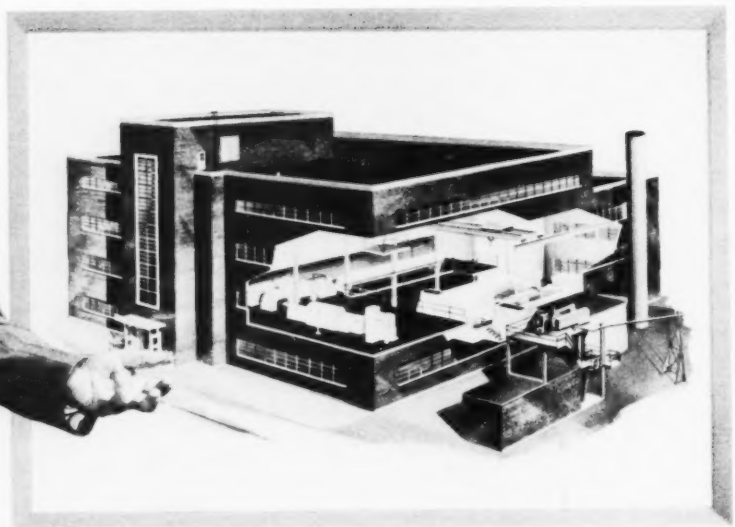
Motors receive complete operating test and inspection



Air gap check is part of final inspection

Westinghouse

From this new laboratory will come tomorrow's prime movers



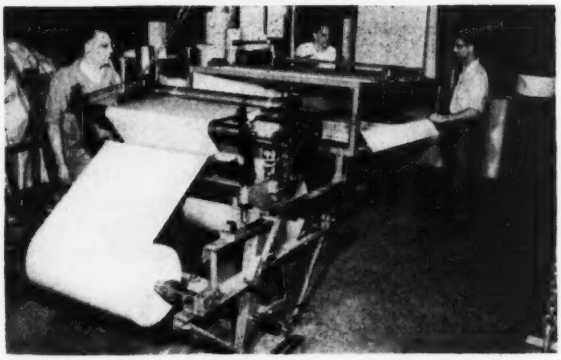
The new Westinghouse Steam and Gas Turbine Development Laboratory, at South Philadelphia, is a $6,000,000 investment in future higher capacity turbine-generators—the designs for which are even now being evolved.

Turbine development is in a highly dynamic state. Unit capacity is increasing almost daily. Steam conditions are at 2400 psig, 1100 degrees; and are headed for 5000 psig, 1250 degrees. The new laboratory will make possible the necessary facilities for solving problems of fluid flow, metallurgy, combustion and heat transfer. Such development is establishing the pattern of tomorrow's larger, and even more efficient machines.

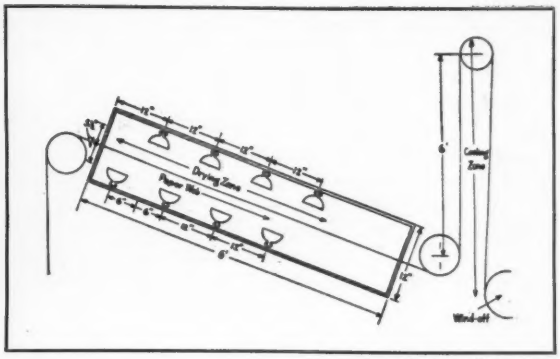
If you would like more information on the general subject of generation, or those products specifically presented on the preceding pages, call your Westinghouse representative or write direct to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. CP-1006

YOU CAN BE SURE...IF IT'S Westinghouse

INDUSTRIAL APPLICATIONS



RADIANT HEATERS dry glued paper sheets faster than air method. Rumpled sheets and mildew discoloration have been eliminated



Edwin L. Wiegand Co

OVEN SECTION shows arrangement of infrared heaters and cooling zone for paper before winding on rolls. Heaters are movable

Infrared Dries Paper In Seven Seconds

Glued paper sheets are dried in less than 7 sec with infrared electric radiant heaters, at the Beistle Co, Shippensburg, Pa., manufacturers of paper novelties.

The former air drying was slow and often resulted in rumpled sheets, discolored by mildew.

In the mounting operation one dry web and a glued web of paper are joined at a "glue line" and travel from 50 to 65 ft per min through the radiant oven. The production rate varies with type of paper, which ranges all the way from glazed stock to cardboard.

There are two banks of four 1,250-w radiant heaters each—one above, the other beneath the web. The heaters are 5½ in. from the web, on 12-in. centers. With total capacity of 10 kw, an input controller and magnetic contactor provide variable control for each bank of heaters, and each bank has its own individual push button control.

As a safety measure, provision was made for turning the heaters away from the web when it is not in motion.

All units are linked together and rotate simultaneously at the turn of a hand crank. To permit cooling of the paper, several feet of vertical passage are provided at the take-off end before winding on rolls.

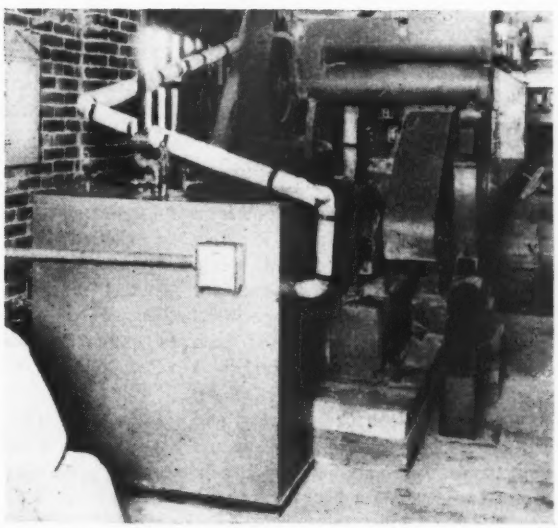
Electric Steam Generator Saves Time and Manhours

M. E. GOODRIDGE, Power Sales Dept, Worcester County Electric Co, Worcester, Mass.

The installation of an electric steam boiler at the J. B. Garland Co., Worcester, Mass., for operation of a live stock food pellet mill has eliminated the need for a licensed boiler engineer during overtime periods. Heat losses are practically eliminated by locating boiler directly beside mill. No smoke pipe or flue connection is needed. Warm-up time is only 10 min and it can be put in service by any of the mill operators by merely closing the switch.

Pellets are formed by moistening the "dry mash" with "dry" steam and then forcing it through ¼-in. to ½-in. holes in the forming plate of a pellet machine.

Cost of steam is an important factor in the profitable production of pellets. At the Garland Co., steam for making pellets is normally provided by a multipurpose 50-lb boiler used as a rubbish burner and for building heating, besides process work. Operation of boiler is supervised by a licensed man who has other duties during the day. For pellet mill operation after 4 p.m. and on Saturdays, the company sought an alternate source of steam. On a trial rental basis, an electric steam boiler with automatic balanced control was installed and proved so successful that it has been permanently connected. Test data obtained

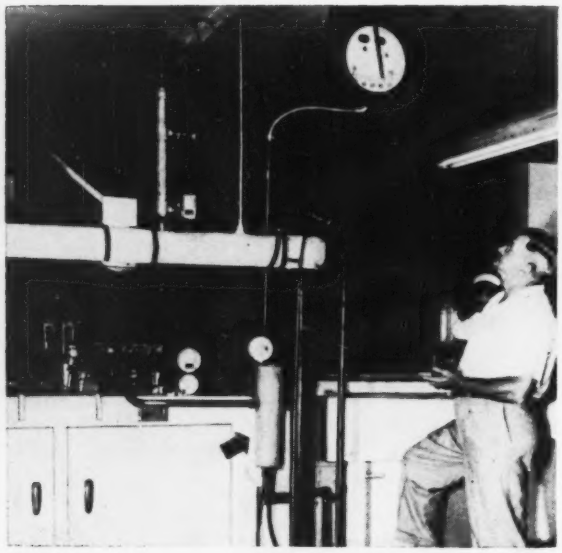


PELLET MILL served by electric steam boiler (at left) during overtime periods. Heat losses are reduced by location beside mill. Boiler can be put into service by any operator by closing the boiler switch

from a demand type watthour meter indicated that adequate steam could be generated at rates varying from 18 kwhr to 25 kwhr per ton of pellets when used with a Sprout-Waldron Jr. model mill. A six boiler hp unit (60 kw) served at 550 v, 3 phase adequately serves this mill and is rated as 100% power factor load.

Operating "off" the peak load of the normal working day, the increment cost for the boiler is 1 1/3¢ per kwhr and produces steam at about 30¢ per ton of pellets. With a mill rated at two tons per hour the electric cost for steam is about 60¢ per hour and operation of mill and boiler is attended by only one operator. For daytime operation "on" the peak load the cost of electric power will be about 45¢ per ton of pellets. Present overtime use with the electric steam boiler averages 10 hr per week but will increase with seasonal demands for pellet feeds.

Another refinement in this installation is the use of a load limiting signal. With push button controls on the many conveyors, grinding mills and mixers, it has been decided to try to avoid high demands when it will not limit the output of the plant. Whenever the load setting of the relay is exceeded for more than 2 min, an alarm signal will warn the foreman to back off the load on some machine temporarily. With this control it is expected that the electric boiler can be used in the daytime during the summer months when the building heating load is "off" and when the large boiler is out of service for annual inspection.



Circulation Heaters Provide Close Temperature Control

Accurately controlled bath temperatures for chocolate are maintained with four 1000-w electric circulation heaters at Reese Candy Co., Hershey, Pa. Temperatures are kept between 84 and 88 F.

Vigorous circulation through the completely jacketed hopper is maintained by means of a 5-gal per min, constant speed, constant volume, motor-driven pump, with bi-pass for regulation of quantity of discharge. An indicating thermostatic control with large dial was mounted so that constant check of temperature can be maintained at a distance from the equipment. A thermostat is also provided on the heater itself as top limit control.

BATH TEMPERATURES for chocolate are closely controlled with electric circulation heaters and indicating thermostat

INDUSTRIAL BRIEFS

Precision control of electric power in photo composing machine at Progress Lithographing Co, Cincinnati, Ohio, provides sharp pin point accuracy for color printing. Motions and positions can be exactly duplicated for each operation so that color overlap is eliminated. Machine employs 2¾-hp motors and control for horizontal and vertical motions; 1½-hp motor and control for vacuum pump, 1¼-hp motor and starter for back board; and one 230-v arc lamp. All motors are 3 phase, 230 v, 60 cycle. L. J. Langevin, Power Eng, Cincinnati Gas & Electric Co.

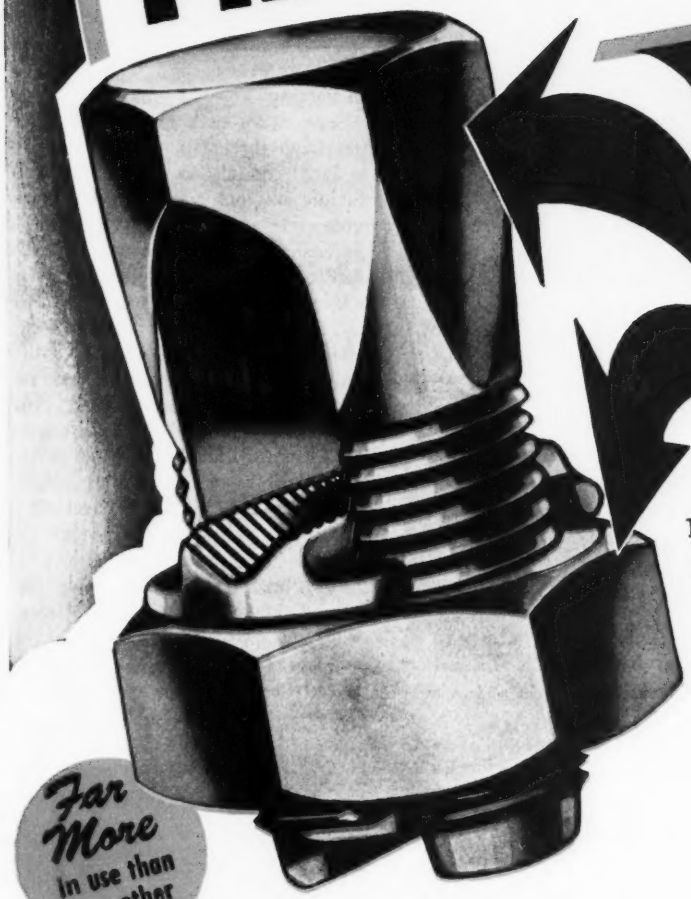
Setting adhesive (thermal setting) used in applying Formica to rounded corners and other irregular surfaces at Scio Cabinet Co., Scio, O., is accomplished by heat from stainless steel strips cut to size and connected across secondary of a 10-kva, 240-v to 18-v transformer. Temperature of strip is controlled by clamp-on thermostat applied directly to strip, which is held against Formica by air pressure in sections of fire hose. R. W. Hunt, Commercial Sales Rep, Ohio Power Co, Dennison, O.

Degreasing wheelbarrow bodies with a 91-kw infrared lamp bank prior to painting, at the Jackson Mfg. Co., Harrisburg, Pa. has improved the product, increased production, saved labor and decreased overall unit cost. A thin film of oil is applied to the steel before the pressing operation. This film was formerly partially removed by wiping rags resulting in an unsatisfactory paint application. Now the barrow bodies are passed through the infrared bank at a rate of 6 to 8 ft per min where the oil film is completely burned at readings of 450 to 500 F. J. V. Ford, Industrial Rep., Pennsylvania Power & Light Co, Harrisburg.

Conveyor (driven by a 1-hp motor and costing about $800) at the Town Line Dairy Farm, Upton, Mass., automatically carries bales of hay 120 ft from front to rear of barn and enables operator to complete his haying of 150 tons in two weeks against one month formerly. This saved at least $500 last season, 35 tons of hay being rescued by fast handling ahead of rainy weather. Hay is unloaded at rate of 10 bales per min., and cost of putting up hay is about 2¢ per bale. The conveyor can be raised or lowered by one man and has variable speed. Power Sales Dept, Worcester County Electric Co.

Approved by UNDERWRITERS LABORATORIES

Here's the MOST PRACTICAL design



LARGER SURFACES

to grip with wrenches from ANY ANGLE—using either a socket or open-end wrench.

MORE STRENGTH. In competitive torque tests, Penn-Union Split-Bolt Connector withstands 15% to 55% higher clamping pressures.

MAXIMUM CONTACT provided by V-groove; conductors protected by beveled slot.

PRECISION MADE, with rigid inspection. Smooth accurate threads assure maximum pressure—permanently maintained.

Far More in use than any other

For taps, dead-ends, parallel connections, etc., in any location. Can be furnished in bronze or aluminum. Re-usable over and over.

With or without retainer

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

The COMPLETE Line of Conductor Fitting.

PENN-UNION

ELECTRIC HEATING FOR HOMES took a most conspicuous forward step when it was incorporated in this 600 apartment, 230 building, 120 acre Stones River development.

HOUSES are of frame construction with brick veneer. Apartments have from one to three bedrooms. Windows are of tight fitting metal sash

Electric Heat By the Acre

600-apartment Stones River development near Tennessee air force base provides 6,215 kw load

MELVIN H. WESSEL, Cavalier Corporation, Chattanooga, Tennessee

Installation of 6,215 kw of electric house heating in the Stones River project near Stewart Air Base, Smyrna, Tenn., marked this as one of the world's largest electrically heated housing developments. Recently completed, Stones River has 600 apartment units in 230 buildings covering 120 acres.

Units vary in size from one to three bedrooms, with from 600 to 1,347 sq ft. Buildings are well constructed to prevent heat losses. Windows are tight fitting metal sash. Walls are of drywall construction with ½-in. gypsum board and 3⅝-in. mineral wool insulation. Ceilings, too, have 3⅝ inches of mineral wool. Outside the outer wall framing is a ⅝-in. insulating board, a one-inch air space and brick veneer. Elimination of flues, except where there are fireplaces, reduced construction costs considerably.

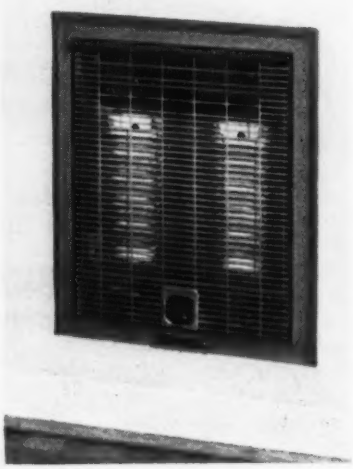
The more than 3,200 electric heaters used in the project are the radiant-convector type. They vary in size from 1,250 watt units in the bathrooms, 1,500 and 2,000 watt in the bedrooms and kitchen to 3,000 watt units in the living room.

Each apartment is served through a 100-amp flush mounted panel which also serves the electric range and water heater, as well as the refrigerator and all lighting.

Services for each apartment vary in size from three No. 4 conductors in ¼-inch conduit to three 2/0 conductors in 2-inch conduit. Meters are rated at 15 amp, 240 volts, 3 wire.

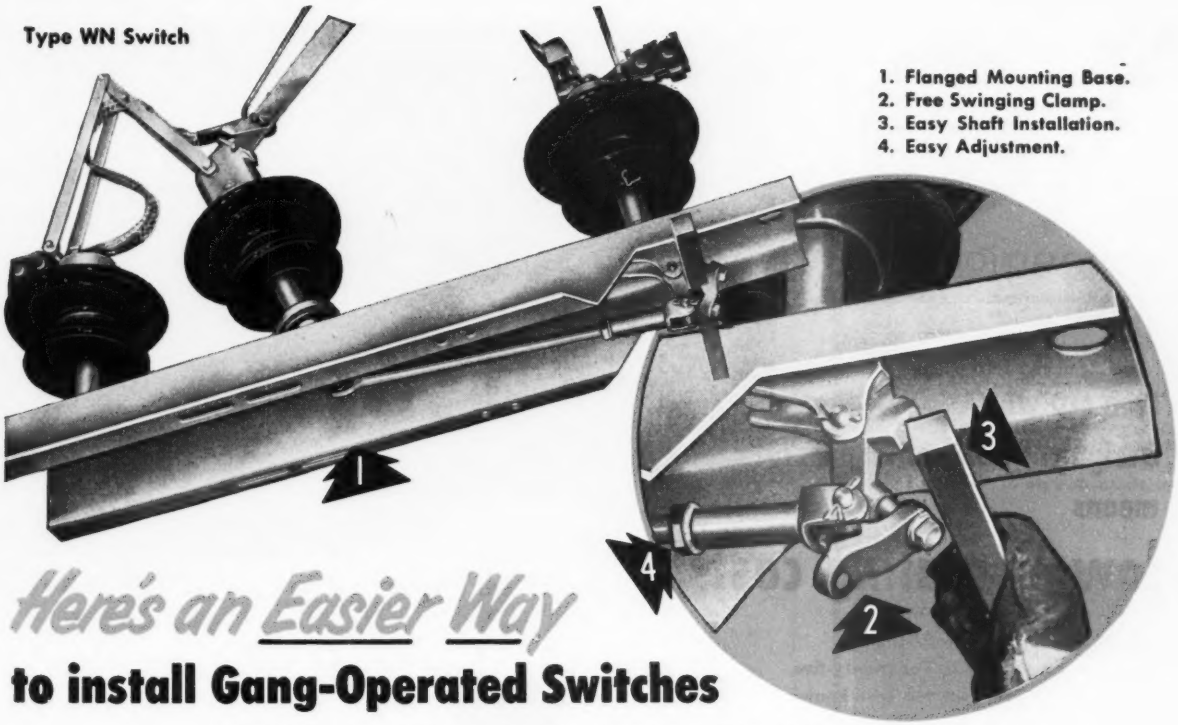
Installed heating capacity varies with the different sizes and locations of housing units. The largest, 13,840 cu ft, has 18 kw and the smallest, 4,040 cu ft, has 8.25 kw. The average capacity is 1.63 kw per 1,000 cu ft. Estimated annual heating cost ranges from $50 to $130 on the standard TVA distributor rate which drops to 0.4¢ per kwhr for monthly usages between 400 and 1,400 kwhr and averages 0.75¢ per kwhr for usages of 1,400 kwhr or more.

Fifty-three transformers serve the project. These consist of 30 75 kva, 19 50 kva, two 37.5 kva, one 15 kva and one 25 kva.



HEATERS are radiant convector type and vary in size from 1,250 to 3,000 watts

Type WN Switch



1. Flanged Mounting Base.
2. Free Swinging Clamp.
3. Easy Shaft Installation.
4. Easy Adjustment.

Here's an Easier Way
to install Gang-Operated Switches

CHANCE WN-VN SWITCHES

permit quick installation of interphase shaft without "threading"

Chance Tilting Insulator Switches for outdoor gang operation give you always reliable switching under all conditions. The reason? . . . Such operating advantages as the exclusive Compensator Control Mechanism that means positive performance under all conditions—"Crow Bar" Leverage that breaks heavy ice with ease—Compensation for structural warpage—and *New Ease of Installation.*

WN-VN Switches *are* easier to install than any other gang-operated switches. The arrows in the illustration above point out the features that make installation simple.

1. The flanged base has double slots and slotted holes for ready installation on all standard construction. (Front mounting brackets are supplied for steel structures.)

2. The clamp on each switch swings open to permit the interphase shaft to be laid in position *after* the switch units are mounted.

3. The interphase shaft bar is then inserted in all three phases at once—without the necessity of "threading" through small fittings.

4. Easy adjustment (only necessary under unusual conditions*) is accomplished by pulling the stainless steel pin which connects the compensator control rod, loosening the lock nut (4), and turning to adjust.

All control connections on Chance WN-VN Switches are made with clamp type fittings for maximum flexibility.

Rugged "torture rack" tests prove that the performance of these switches is not affected by any conceivable warpage of cross-arms—Ice tests prove their exceptional ability to open and close without difficulty when coated with over ¾" of hard, clear ice. Chance WN-VN Switches can be isolated, while energized, with Hot Line Tools for live line maintenance.

For reliable switching *plus* time saving installation advantages, specify Chance Type WN or VN Switches.

Send for complete catalog information or test data or consult Section 11B of your Chance catalog.

**All WN or VN switches are factory adjusted for proper contact and gap clearance before shipment.*

You know it's RIGHT when you specify CHANCE

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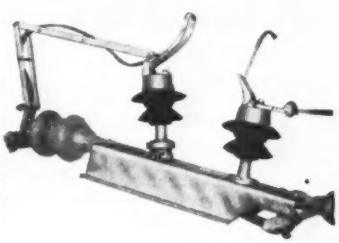

Chance Type VN 200 Amp. Switch. A two-insulator tilting type switch built for service and economy.

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Send today for our new 32-page experience-record book. For twenty-five years, Kaiser Engineers has been known for its ability to design and build plants with low operating costs.

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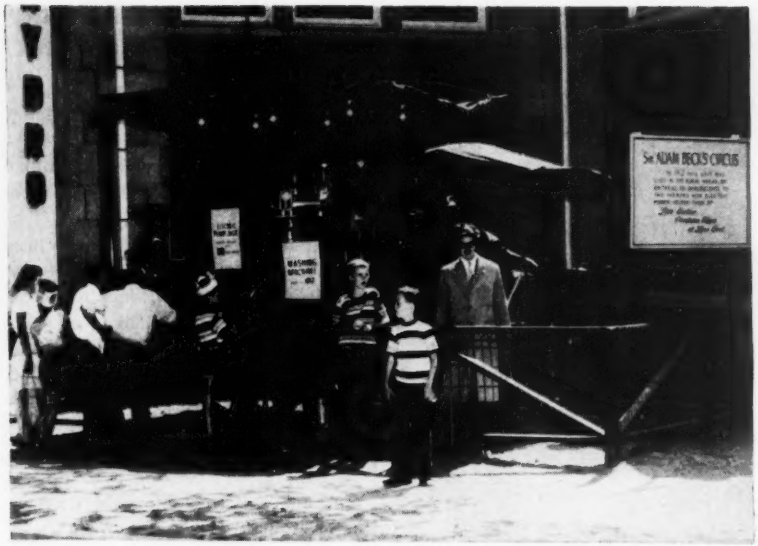


Just as in 1912, this truck is making the Canadian circuit . . .

Selling Electricity to Farmers

In 1912 a snappy new truck, painted fire-engine red, started a tour, sponsored by Hydro Electric Power Commission of Ontario to sell electricity to farmers. Today, this 1912 truck, with all its original equipment and displays, is on another Hydro tour to demonstrate the advantages of electricity.

Forty-one years ago, the truck, equipped with such new-fangled machines as a buzz saw, milking machine, washing machine, pump jack, grain grinder, cream separator, and butter churn—all under electric lights for night display—had all the trappings that earned it its nickname: "Adam Beck's Circus".

Beck—more formally known as Sir Adam—was first chairman of Ontario Hydro. He devised the original barnstorming tour with all of the equipment on two trucks. One was the 1912 two-cylinder Autocar shown above, which generated its own power to run the show.

The tour had some amusing sidelights. Once Sir Adam and his engineers set up in a rural area to demonstrate their new electric milker for several of the curious but skeptical farmers.

With all the flourishes of a medicine-show man, Sir Adam asked to have a cow brought forward. Winking to his cohorts, a farmer went out to get one.

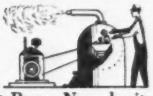
Sir Adam accepted with thanks and attached the milker. He turned it on. Nothing happened. He turned it off and tinkered. He turned it on again. Nothing happened. Then he realized the joke was on him. The farmer had brought him a dry cow.

Big Success . . . Sir Adam sold the farmers on the advantages of electricity so thoroughly, according to Robert H. Saunders, Hydro's chairman, that farmers now accept electric power as their most valuable hired hand. It will do the mechanical work equivalent to an average hired man's work in an eight hour day—and at much less cost. In Canada, where the manpower problem is acute, this is even more important than dollar savings, he pointed out.

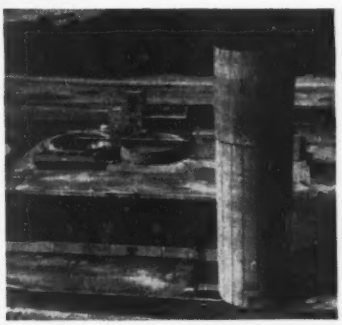
The original truck traveled the countryside until 1922, piling up over 10,000 miles a year before it was retired. It was picked up later by the district manager of the Autocar Sales & Service Co. located in Buffalo, N. Y.

It was loaned to Ontario Hydro for the Canadian Exposition in 1952, where it was seen, with all of its original equipment and displays, by nearly 3 million people. This convinced Hydro officials that they ought to repurchase, for exhibition purposes, the sales tool that had been so successful four decades before.

what's NEW in Engineering



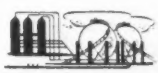
Supersonic waves pulverize rock in a new milling machine. Recently demonstrated at Reno, Nev., by its inventor Joseph Bassick, the machine turns nonmetallic rock to powder instantly. Crushing impact is delivered by sound waves. It promises to work on metals, too.



How to produce a ton of steel using only 1400 gallons of water—instead of the industry average of 65,000 gallons—was the problem facing Kaiser Engineers in building the West's only completely integrated steel mill at Fontana, Calif. For details, just drop us a line. We'll send you a reprint of a recent article about it in *Plant Engineering* magazine.

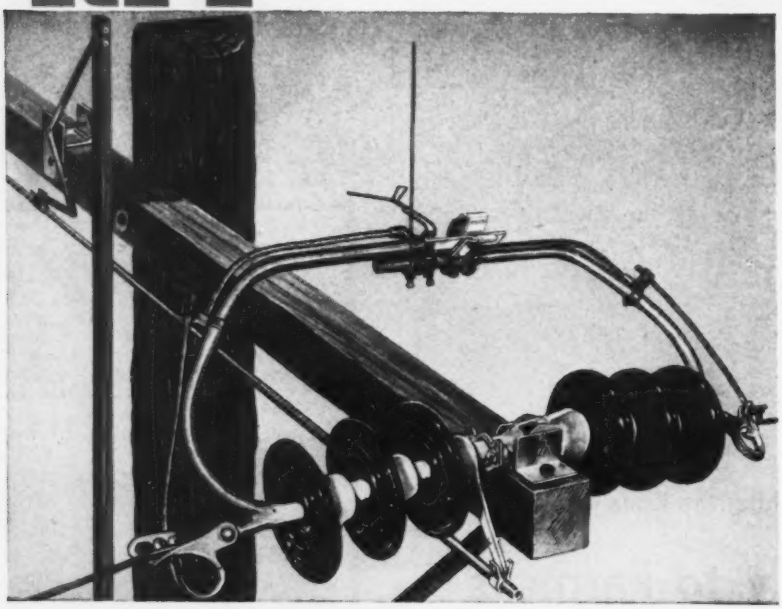
A new gadget—the pocket-sized double right angle prism—is proving a boon to many engineers in the field. Major advantage is the fact that you can look through it—straight ahead on the line of sight—and at a right angle at the same time.

"Engineering Statistics and Quality Control" is an important new book by Irving W. Burr, professor of mathematics at Purdue. Due for July publication, it is clear, unified, practical. Primary emphasis is on statistics most immediate and usable in industry.



Our new experience-record book shows Kaiser Engineers is now designing and building in such diverse fields as petroleum refining, mining, industrial and municipal waste and water treatment plants. For your copy, just write: Kaiser Engineers Division of Henry J. Kaiser Co., Kaiser Bldg., Oakland 12, Calif.

KPF POLE TOP SWITCHES



Simple design means more switch ...for less money!

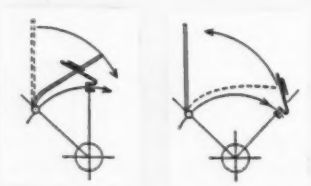
KPF Pole Top Switches cost less because they are simplest in design. They lower installation costs because they bolt on a single crossarm in minutes, require no extra insulators. KPF switches save, too, on upkeep; simple push-pull interphase rods never bind because of crossarm warpage; monel and bronze bearings never need lubrication.

KPF switches may be used in horizontal, vertical or triangular mounting. Free floating, self aligning blades and jaws maintain proper contact under all conditions of switch sag adjustment.

NEW QUICK-BREAK ATTACHMENT FOR KPF SWITCHES

The split-second breaking speed of these new KPF attachments means you can switch many circuits without using expensive circuit breakers. Attachment is available for all KPF switches rated 15 to 69 kv.

WRITE FOR DETAILS



Spring rod winds to full tension as switch opens.

Rod springs clear, breaking contact at high speed.

KPF ELECTRIC COMPANY
1624 E. Alpine Avenue • Stockton 5, Calif.

New Fluorescent-Mercury Lamp Nears Production

Production will start soon on a new 700-w fluorescent-mercury lamp, described for the first time at a regional conference of the Illuminating Engineering Society in Los Angeles last month.

Explaining that the bulb fills a need that can't be met by either the 400-w or 1000-w fluorescent-mercury unit, William B. Gero, manager of commercial engineering of the Westinghouse Lamp Division, Bloomfield, N. J., predicted it will be popular in congested shopping areas where bright light and color perception are important. It will provide two and one half times more white light than incandescent street lamps without increasing power costs, and will burn 5,000 to 6,000 hours, Gero said.

Chicago Area Wiring Program Outlined

An industry-wide campaign to promote adequate home wiring in the Chicago area was announced this month by H. C. Moses, Jr., district manager, Thomas & Betts Co, in a talk before the Electric Association of Chicago. Moses, who is chairman of the association's adequate wiring committee, said that a series of conferences was being planned to alert the whole industry. In addition, he said, a speakers bureau was being organized to describe the benefits of adequate wiring to community groups.

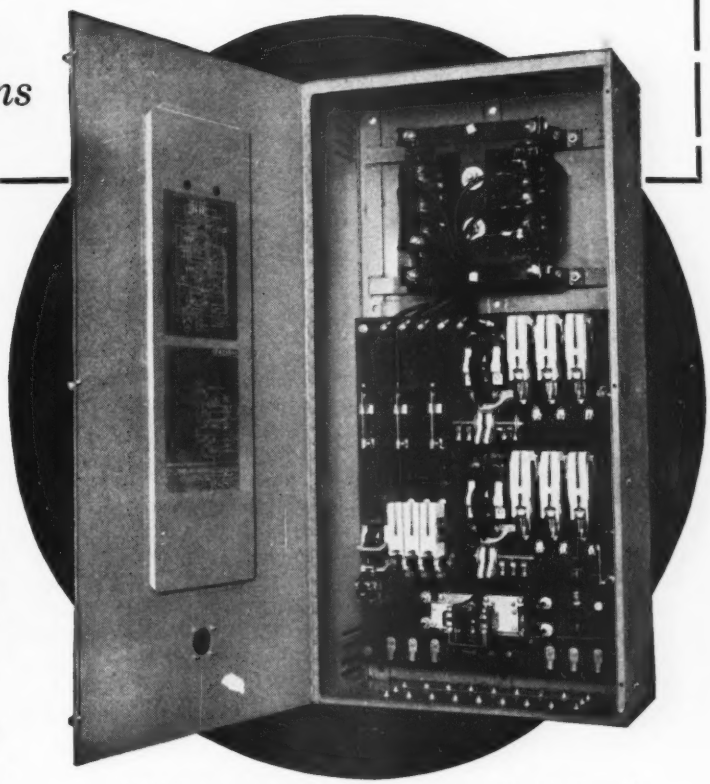
At first there will be separate meetings for manufacturers, jobbers, utilities, unions, and contractors to develop the particular contribution of each in the program, Moses explained. Then, he added, an overall conference will be held next fall to coordinate all efforts into an effective drive.

Appliances Take to Water

The shipment of appliances to market by water—another first in the development of General Electric Co's new Appliance Park at Louisville—was chalked up last month. Three truck-van loads of ranges and electric sinks—48 ranges and 28 electric sinks—were carried by a barge on the Ohio River from Louisville to a General Electric distributor located in Cincinnati.

CUTLER-HAMMER USES K & M EBONIZED ASBESTOS

in this starter for marine applications



K&M Ebonized Asbestos is used for the mounting panel in Cutler-Hammer's A. C., Magnetic, Auto-Transformer type Starter for Marine Applications.

Marine starter mounting panels need to be strong, shatterproof, as light as possible, and, of course, of high insulating quality. K&M Ebonized Asbestos, composed of tough, mineral asbestos fiber and binding cement, molded under pressure and impregnated with a special insulating compound, is right for the job.

Cutler-Hammer, Inc. has found K&M Ebonized Asbestos strong, light in weight, and uniformly dependable as an insulator. In addition, it is easy to work, and economical.

You'll find K&M Ebonized Asbestos fits your panel-mounting requirements, too—whether you manufacture or use switchboard mountings, bus bar runs, switchgear compartment linings, test tables, bench boards or other equipment.

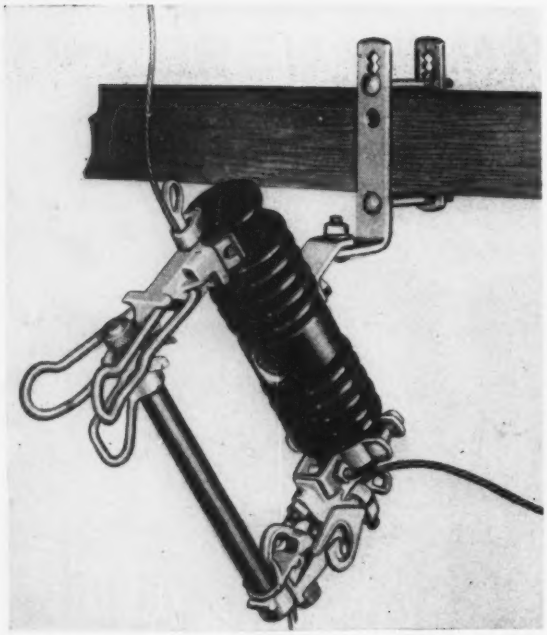
K&M Ebonized Asbestos is supplied in sheets 42" x 96", ⅛" to 4" thick, and in sheets 48" x 96", ¼" to 2" thick. It may also be ordered cut to specific sizes, and with beveled edges. We'll be glad to send you complete information.

Nature made Asbestos... Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

In Canada: Atlas Asbestos Co., Ltd. • Montreal, Toronto, Winnipeg and Vancouver

NEW EQUIPMENT



Cutout

Type HCO, 100-amp heavy-duty cutout is rated at 5 kv, 7.5 kv and 15 kv, and has an interrupting capacity of 8,000 amp. Its operation is based on single venting of fuse tube on low faults (up to 2,000 amp) and double venting on high faults.

Top contacts and bottom hinges are designed so that the cartridge cannot miss the top contact. Current carrying parts are silver plated and the cutout is designed for button-head distribution fuse links.

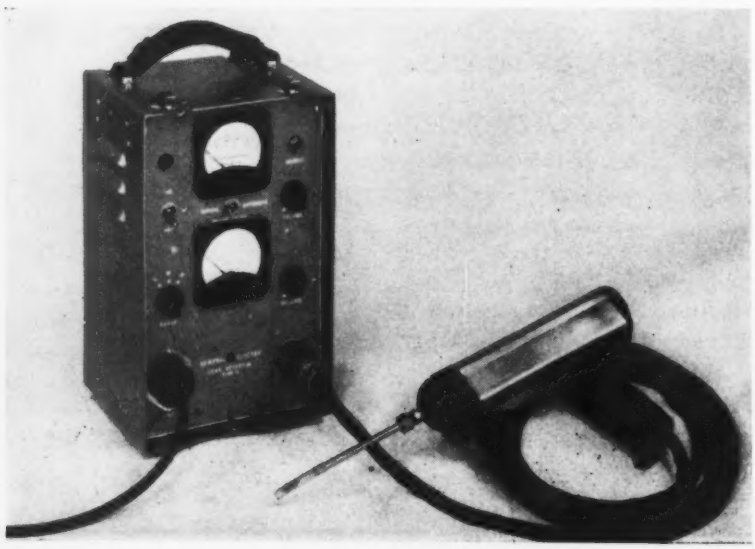
Line Material Co, Milwaukee, Wis.

Phase Shifter

The 50-va, type-R-½ phase shifter is useful for calibrating watthour meters. Any phase angle displacement, which may be desired, can be obtained, the manufacturer claims.

The construction is similar to a polyphase induction motor, having a stator and rotor. However, rotor does not spin but is rotated and held stationary in any desired position. A graduated scale facilitates positioning of the rotor.

The States Co., Hartford, Conn.



Leak Detector

For testing leaks in boilers, piping and tanks, it is capable of detecting a leak of 1/100 oz of gas passing through an opening in a year. A halogen gas must be introduced into the system to act as a tracer. Indication of a leak is by means of a dial, earphone, or built-in loudspeaker.

Detector also features an automatic balancing circuit that is said to compensate for changes in air contamination and a voltage stabilizer.

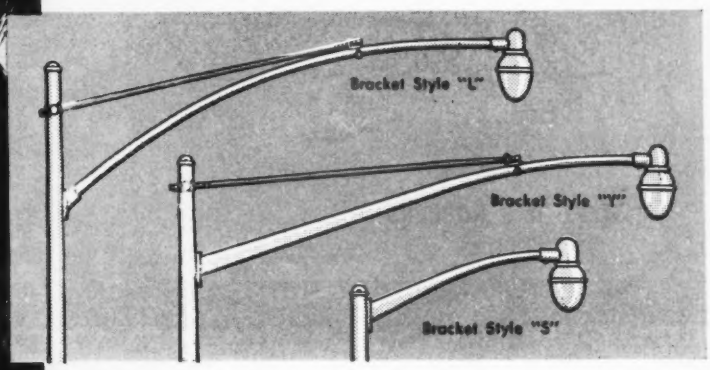
General Electric Co, Schenectady 5, N. Y.

For Lasting Beauty . . .

HAPCO aluminum alloy street lighting standards and brackets

HAPCO Aluminum Alloy Street Lighting Standards and Brackets combine light weight with permanent beauty and unsurpassed durability. Their weight is approximately a third of their steel counterparts, and installation costs are held to a minimum. Two men, operating with a light truck, can easily install these standards completely assembled with bracket and luminaire.

Write for either or both of these Catalogs: "HAPCO Aluminum Alloy Street Lighting Standards and Poles" and "HAPCO Street Lighting Brackets and Mast Arms".



- Pole heights to 40-feet.
- Pole diameters, 8-inches or under, tapering to 4-inches.
- All poles are seamless and jointless.
- Four 1 by 36-inch galvanized steel Anchor Bolts are furnished with each pole.
- Tapering is produced from a single tube by a special process.
- Brackets normally supplied with 1¼-inch slip-fitter end. May also be furnished with 2-inch slip-fitter, 2-inch threaded end, or 1¼-inch threaded end if specified.
- Hand holes furnished extra on request on Type No. 1 Poles.
- Brackets are seamless, jointless, and may be either tapered or uniform in diameter.
- Bracket lengths from 3-feet.
- Twin brackets or special bracket styles to your specifications.
- Bolt covers to conceal unsightly bolt ends are included.

HUBBARD ALUMINUM PRODUCTS COMPANY

MANUFACTURERS OF HAPCO QUALITY ALUMINUM PRODUCTS

A Division of HUBBARD and COMPANY

6301 Butler Street • Pittsburgh 1, Pa.

"Make it a **KOPPERS POLE** . . . I want it to last!"

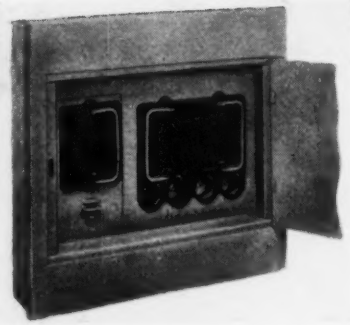
IT'S easy to appreciate this art-lover's attitude. Like all linemen, he thinks of Koppers Poles in terms of permanency.

Koppers Poles *do* last. Not just for years—but for decades. By retaining their strength, these poles provide exceptionally long periods of *uninterrupted* service. This, in turn, means far less maintenance work . . . more revenue . . . improved customer relations.

The next time you're in the market for poles, let us give you our quotation. Koppers Full-Length Pressure-Creosoted Poles can be delivered from our many conveniently-located treating plants.

KOPPERS COMPANY, INC.
WOOD PRESERVING DIVISION
PITTSBURGH 19, PA.

KOPPERS **PRESSURE-CREOSOTED WOOD**

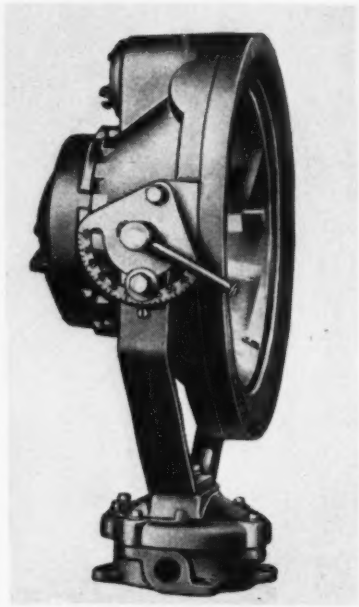


Service Equipment

With three or four pullouts for four, six or eight branch circuits, the PJ Series has a 60-amp main. One pullout, available in 30 or 60 amps, can be isolated in a sealable compartment.

Features claimed include: wiring room; dead front construction; one piece fuse clip and blade; load, line and neutral terminals located for easy wiring; surface hook-on cover; and baked-on Melamine finish.

Murray Manufacturing Corp, Brooklyn, N. Y.



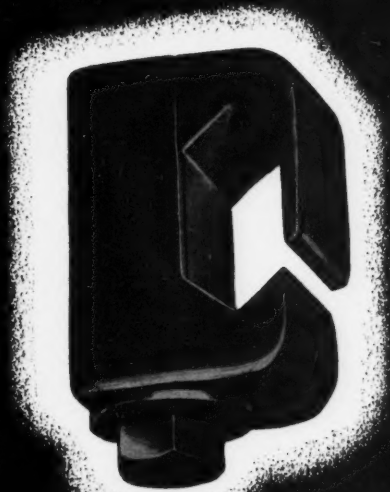
Floodlight

The RLEE-14, rated 500 w, is designed for use in hazardous locations. It has a tempered and impact resisting lens, and a separate explosion-proof wiring compartment in its base. This is isolated from the lamp compartment by an explosion-proof seal.

Crouse-Hinds Co, Syracuse, N. Y.

Unsurpassed for

High Conductivity
Ease of Installation
Safety
Overall Economy



FARGO CONNECTORS*

Fargo Connectors *grip like a vise* to give an ideal . . . vibration-proof contact — high in conductivity . . . with high compression at low wrench torque. They are easy and safe to handle . . . require no attention after installation — and can be used over and over again. Ask your Line Material Sales Engineer to give you the complete details on these, as well as the other time and labor saving devices in the Fargo line.

*Approved by Underwriters' Laboratories, Inc.

. . . "built like a vise — grip like a vise."

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N.Y.

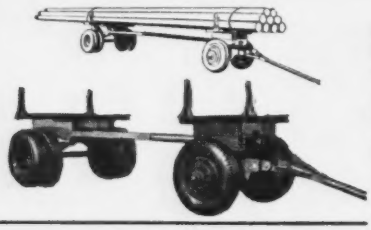
Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin

LM®

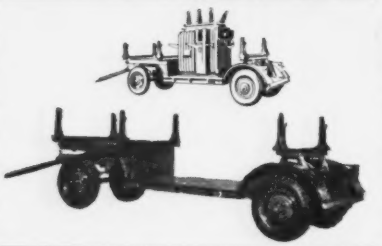
Notes on Eagle Equipment — Designed to save man-hours and money

TRAILERS

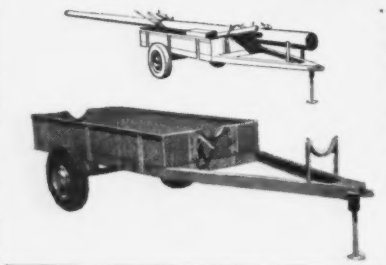
...IN A WIDE RANGE OF SIZES AND TYPES



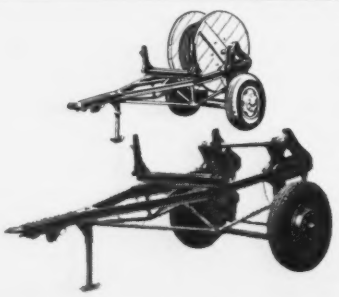
ADJUSTABLE LENGTH POLE TRAILER: easily adjusts to accommodate poles up to 90 ft. long — a big trailer that does a big job. Center pole telescopes. Trails smoothly. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6450.



FOUR-WHEEL LO-BED TRAILER: for easy loading and hauling of heavy bulky units, also suited to pole and general purpose hauling. Five ton capacity, overall length 25 ft. 8 inches. Distance ground to low platform only 25½ inches. Equipped with electric brakes on rear wheels. Get complete information on Eagle Trailer Model 6441.



LIGHT-DUTY CARGO AND GENERAL PURPOSE TRAILER: light-duty, 1-ton capacity trailer for hauling one or two poles, cross-arms, pole hardware, etc. Has pole saddles front and rear and removable end boards. Get complete information on Eagle Trailer Model 7163.



COMBINATION CABLE REEL AND POLE TRAILER: complete with bolsters, stanchions, cable reel saddles. Quickly converted into a pole trailer by removing cable reel saddles and installing bolsters. A practical dual purpose unit, requiring only one trailer license. Get complete information on Eagle Trailer PCP — W-PCP series.

Send today for the complete catalog of Eagle Line Construction and Maintenance Equipment — a useful reference book.

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EQUIPMENT ENGINEERED BY AND FOR UTILITY MEN EXPRESSLY FOR THEIR NEEDS

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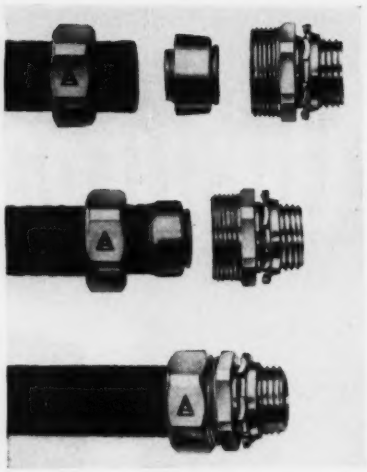
EAGLE MANUFACTURING CO., Appleton, Wis.

Division of The Four Wheel Drive Auto Co.



Connectors

They are UL approved for protection of electrical conductors on machinery where liquid-tight flexible conduit is used. ST series provides for an all-metal flaring ferrule that is securely joined with flexible conduit.

Connectors are available in conduit sizes ⅜, ½, ¾, 1 and 1¼ in. for straight, 45- and 90-deg connections.

Appleton Electric Co, Chicago, Ill.

CO_2 Extinguishers

Available in five models—2½, 5, 10, 15 and 20 lb—the line has a new valve. Features of the valve include: Increased simplicity, disassembles for servicing without special tools; operates fast; good leverage, hand squeeze needs finger pressure; removable siphon tube; safety disc is side mounted instead of on top.

Units carry the approval of Underwriters' and Factory Mutual Laboratories.

American - LaFrance - Foamite Corp, Elmira, N. Y.

Whiteprinter

Speed Master, model S, uses a 2,000-w high-pressure Vicor jacketed glass lamp and the dry ammonia-fume method of diazo reproduction. Printing speed is from 6 ipm to 14 fpm; develops fully at 8 fpm, it is claimed. Blower system provides cool contact glass surface.

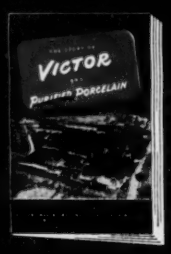
The printer handles cut-sheets or roll stock up to 42 in. wide. Variable temperature control provides adjust-

IT TAKES MORE THAN THIS HAMMER BLOW TO INJURE——

VICTOR PURIFIED PORCELAIN!

See that hammer falling? It's about to strike the outer edge of a Victor Suspension Insulator with a blow that *greatly exceeds specifications!* This is routine control procedure in Victor's test laboratories. It proves that insulators made of *Purified Porcelain* consistently withstand impacts in excess of NEMA standards. This finest porcelain ever made is more dense, harder, tougher and far more resistant to impact than any other porcelain yet developed. For full data on Victor Suspension Insulators, write for Bulletin No. 4.

Victor No. 900, 10" Suspension Insulator being subjected to impact test in Victor's Test Laboratories.



FREE BOOKLET gives you the full story on how Victor insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

VICTOR NO. 900 SUSPENSION

Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain

the latest unit in a proven line of... PHOTOELECTRIC CONTROLS for street lighting

The new improved F-P Control 63300C is the result of eight years of practical experience in photo electric control for street lighting. Developed in conjunction with leading utility engineers, the new unit provides:

ACCESSIBILITY — The potentiometer is easily adjusted and the circuit fuse quickly changed without removing the meter glass. All major components are readily accessible.

SWITCHING CAPACITY — A SPDT double break power contactor is built into the control chassis. The normally closed contacts energize a lighting load at night up to 3000 watts. The normally open contacts energize a load during daytime up to 2000 watts. These ratings apply to incandescent, mercury or sodium vapor lamps.

PROTECTION — The F-P Series 63300C Control is conservatively rated 3000 volts RMS hipot between any part of the circuit and ground. In the event of functional failure of the circuit, the controlled lighting load will remain on.

HIGHEST QUALITY components are used throughout. All tubes are preaged and tested to give a nominal life of over 20,000 burning hours. All other components have much longer life. Fisher-Pierce Photoelectric Controls have been proven reliable by the experience of hundreds of utilities in thousands of installations.

METAL ENCASED CONDENSERS
CIRCUIT FUSE Easily checked
PHENOLIC SUBMOUNTING CHASSIS Maximum component protection
NEW PILOT RELAY Balanced armature construction
NEW POWER CONTACTOR Night load energized on normally closed contact.
POTENTIOMETER Readily accessible
CLEAN METER PLATE Nothing to interfere with external wiring

Write for Catalog.

The FISHER-PIERCE CO., Inc.

82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP. 100 E. 42nd STREET NEW YORK 17, N.Y.

IN CANADA: NORTHERN ELECTRIC CO., Ltd.

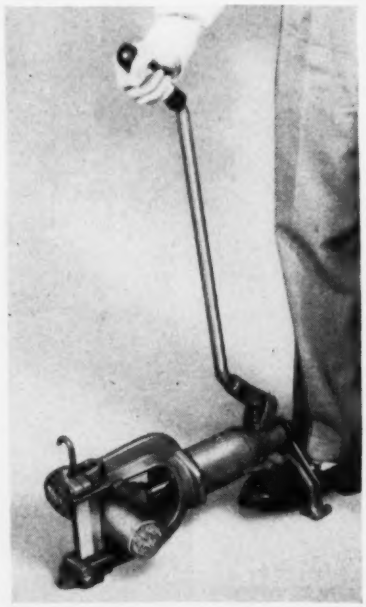
ment of different sensitized materials. Input power for the unit is 220 v, 22 amp, single phase, 60 cps.

Peck & Harvey, Chicago 45, Ill.

Chopper

For cutting cable bundles 1½ by 2½ in, model 174-2-A-1 has a case hardened steel blade and is powered by a special 0.38 caliber cartridge. The cartridge is actuated by an electric primer connected to a battery.

Beckman and Whitley, Inc, San Carlos, Calif.



Cable Cutter

It has a capacity up to 3½ in.—lead sheathed and power cable (except submarine cable) up to 3,000 MCM—and requires seven handle strokes per inch of cutting. Hydraulic anvil is self retracting and is controlled by a release valve.

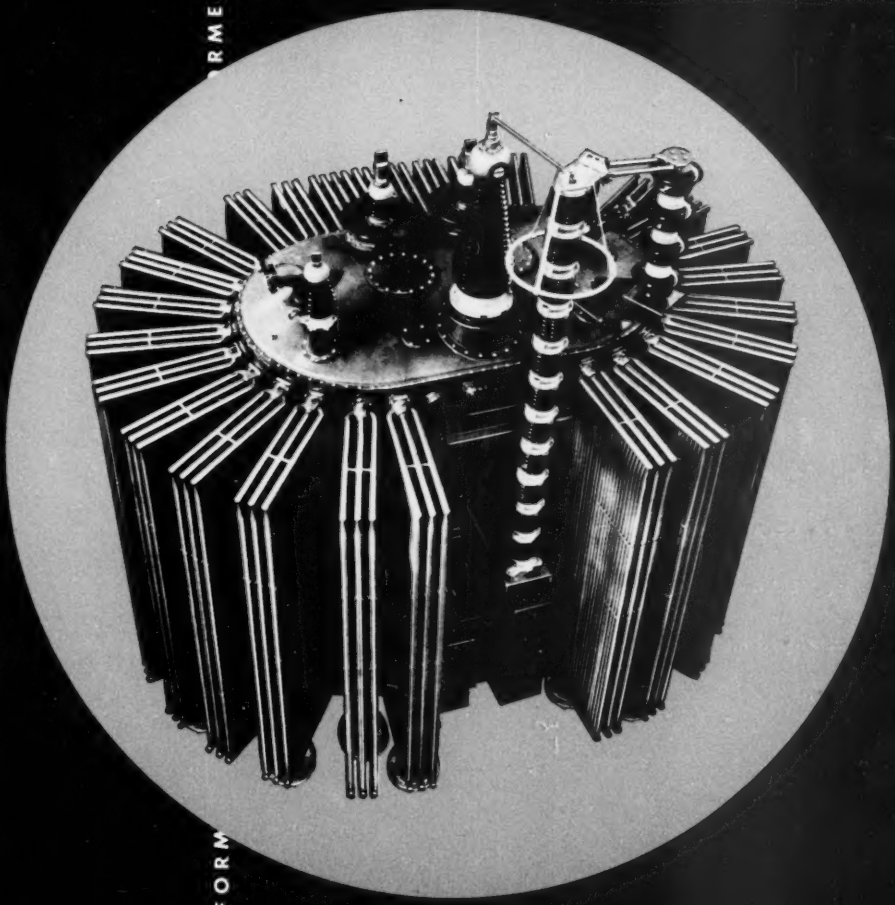
H. K. Porter, Inc, Somerville 43, Mass.

PENNSYLVANIA POWER TRANSFORMER PENNSYLVANIA POWER TRANSFORMER

70,000 kva

SINGLE PHASE

Pennsylvania Power Transformer



In addition to its forced-air rating of 70,000 Kva, this Pennsylvania transformer has a self-cooled rating of 56,000 Kva. Three of these transformers are connected in a 210,000 Kva bank to step up the generator voltage of 19,000 volts to the transmission voltage of 161,000 volts. The transformers were shipped to their destination in an upright position, completely assembled except for bushings and detachable radiators.

pt

Pennsylvania Transformer Company

A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG, PENNSYLVANIA

Greater Pittsburgh District

For Inside Story See Next Page

INSIDE a 70,000 kva SINGLE PHASE Pennsylvania Power Transformer

Two sets of taps per coil assure excellent electrical and mechanical balance in the windings.

Heavy bracing on side frames and on clamping plates provides uniform clamping pressure on core and coils.

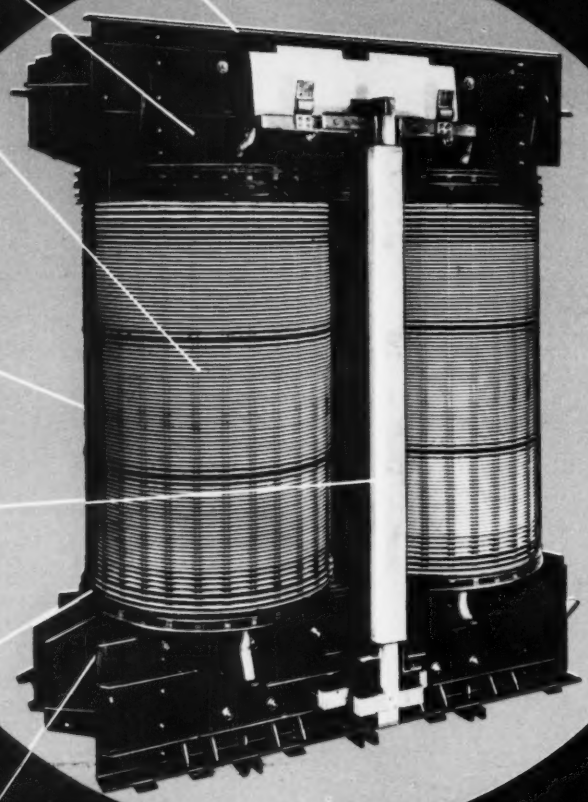
Continuous pancake winding in High Voltage coils. Helical winding in Low Voltage coils.

Coils are precompressed with force equal to highest short circuit stress and built into transformer at that compressed dimension. This prevents mechanical distortion of the coils if short circuit stresses occur.

Low Voltage leads from the coils are well supported and insulated in a pressboard tube.

Extra heavy insulation at line ends of coils. Graded insulation at ground ends of coils.

Rigid self-supporting bolted core contains a large number of cooling ducts for flow of oil across laminations.



70,000 Kva forced-air-cooled 56,000 Kva self-cooled. Single Phase, 60 Cycles, 55°C. Temperature rise. High Voltage: 93,000 161,000 Grd. Y volts Low Voltage: 19,000 volts.

Pennsylvania Transformer Company

A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG PENNSYLVANIA

Greater Pittsburgh

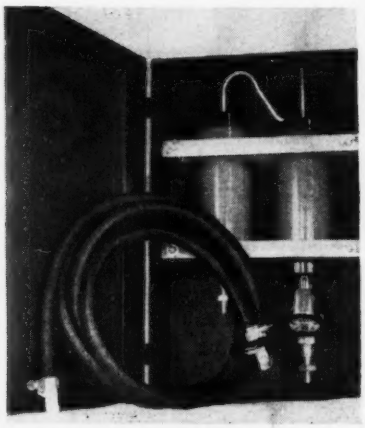
For exterior view of this transformer, see other side.

Electrical Tape

Designated Royalastic, is a plastic film about 6 mils thick. One side has a pressure sensitive adhesive that makes the over-all thickness about 7 mils.

The black tape has a tensile strength of 20 lb per in. of width and a dielectric strength of 10,000 v, it is claimed. It is available in 30- and 66-ft rolls ¾ in. wide and 10-ft rolls ½ in. wide.

United States Rubber Co, New York 20, N. Y.



Phasing Voltmeter

It consists of two resistors and a voltmeter connected in series and is for testing for voltage difference between two circuits to be connected. Means are provided on each resistor housing for connection to a hot stick. The meter has two voltage ranges, 9 and 36 kv.

One resistor can be hooked over a line. A 10-ft lead connects the two resistors. The second resistor, connected to a hot stick, is touched to the other line. Voltage difference between lines is registered on the voltmeter.

Western Electro-Mechanical Co, Inc, Oakland 7, Calif.

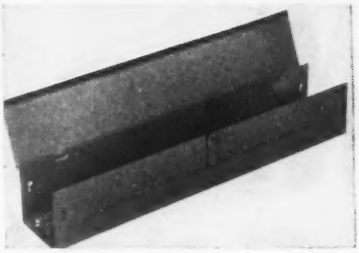
Wattmeter

Model 110 is basically an amplifier driving the potential coil of a dynamometer wattmeter. It has a range from 0.3 to 300 w on six scales, with shunts extending the range to 9,000 w. Frequency response from 20 to 3,000 cps. Accuracy is said to be within 2% of full scale.

Keithley Instruments, Cleveland 15, Ohio

Raceway

Lay-in-Duct is a steel-enclosed wiring trough for feeders, branch circuits, etc. It has a hinged cover and catches for fastening closed.



Ducts are available in 2½ x 2½-in. and 4 x 4-in. sizes in lengths of 1, 2 and 5 ft. Telescope attachments provide a means for connections at distances from 2 to 12 in. Other fittings are available to connect ducts to square duct and panelboards.

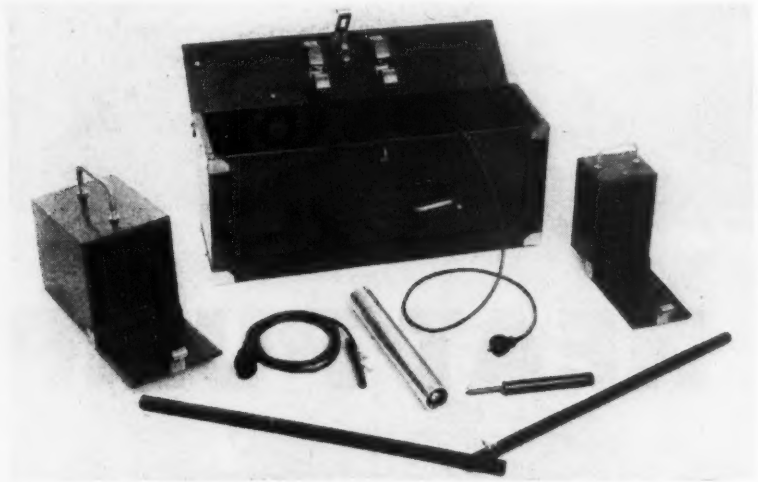
Square D Co, Los Angeles, Calif.

Overload Indicator

For distribution transformers, provides a log of overload performance. Called type PL, the device utilizes a bimetallic thermostat embedded in the transformer winding that is said to give an accurate indication of copper temperature.

An excessive overload turns on a red light, visible from the ground, and also registers on a dial. When the temperature falls, the light goes out but the dial remains in position. This is repeated for five overloads, after which the dial continues to count overloads, but the light stays on to indicate a dangerous condition.

Westinghouse Electric Co, Pittsburgh 30, Pa.



Dynamite Kit

For safe transportation of dynamite, kit includes a 24-stick container, 24 blasting cap container, non-ferrous loading tool, folding wooden tamp bar, connector cable, 100-ft of shot-firing cable, 6-v exploder, and test circuit. Contained in less than one cubic foot, kit is said to be rigidly constructed and can be padlocked.

Clements Manufacturing Co, Dallas 2, Texas

New Opportunity
TO PROMOTE

NEW ORLEANS, LA. This large, two-story home is heated and cooled by G-E Heat Pump installed in basement.

SARASOTA, FLA. G-E Heat Pump is tucked away in corner of garage of this cellarless home.

TOLEDO, OHIO. G-E Heat Pump in basement handles this ranch-type home.

HEAT PUMP

for UTILITIES

ALL-ELECTRIC LIVING

New General Electric Heat Pump boosts residential power sales.... and can broaden market for other major electric appliances

FOR THE FIRST TIME true all-electric living is a practical reality and it brings with it an unparalleled promotional opportunity for utilities. The revolutionary air-source G-E Heat Pump is the ideal year-round air conditioner—it requires no water and burns no fuel. Using only electricity and air, it cools in summer by refrigeration and heats in winter by reversing the refrigeration cycle.

NOW UTILITIES CAN SHARE in the tremendous consumer fuel market. The entire operating expense for home heating and cooling averaging $125-500 per year can become kilowatt-hour sales. The use of the G-E Heat Pump in the average all-electric home should triple or quadruple normal residential power consumption.

G-E HEAT PUMPS HELP BROADEN the market for other major electric appliances. The consumer who has all-electric heating and cooling in his home will surely use an electric water heater and an all-electric kitchen and laundry. Such a homeowner *thinks* in terms of all-electric living!

WHAT UTILITIES ARE DOING TO PROMOTE THE HEAT PUMP. Many electric utilities are holding technical meetings to inform architects and builders about the unusual advantages of the heat pump. Some utilities have installed heat pumps in their own offices as well as in homes of employees. They are training specialists to advise their customers regarding applications and operating costs. G-E sales representatives will be glad to discuss G-E Heat Pump marketing and promotion plans with interested public utility officials.

FOR MORE INFORMATION about the G-E Heat Pump including technical data and promotional literature, or plans for a co-operative promotional program, send the coupon or write on your letterhead to General Electric Company, Heat Pump Department, Air Conditioning Division, Sec. EW-1, Bloomfield, New Jersey.

GENERAL ELECTRIC

Mail Coupon Today!

General Electric Company, Air Conditioning Div., Heat Pump Department, Sec. EW-1, Bloomfield, N. J.

Please send me technical data and utility promotion material on the new G-E Heat Pump.

Name and Title.....

Company.....

Address.....

City.....**Zone**.....**State**.....

LETTERS TO THE EDITOR

A New Term—Pumperator

To the Editor:

At the Connecticut Light & Power Co's Rocky River (pumped storage) hydroelectric plant on the Housatonic River near New Milford, we have two synchronous motor-driven vertical pumps that deliver water into a man-made lake, Lake Candlewood. The motors are General Electric 8,100 hp at 327 rpm.

Our vice-presidents of engineering and operations proposed reversing rotation of these pumps, to get a little more generating capacity for our system. Since installing Isolator switches in the 13.8-kv cables we can now change from pumping to generating with these units. Of course, the machines have to be at a standstill before changing the position of the Isolator switch. It is working out just as the v.p. planned it. We get 3,000 kw out of each of these units which come in handy over our peak load periods.

One of our load dispatchers, while giving me the schedule for the next day for our plant, off-hand coined a new name for these units and now all our dispatchers call these units "Pumperators" when giving schedule to use them for generation.

Albert Trautman
Operator

Rocky River Plant
Gaylordsville, Conn.

• Rocky River is the first pump-storage station to be installed in the U. S. Until the changes that Albert Trautman describes were made its output was limited to the capacity of one 25,000-kva generator driven by a 33,000-hp hydraulic turbine.

Bullet-Proof Glass

To the Editor:

We have an inquiry from a motor car company in San Francisco to build a bullet-proof body on an automobile chassis for the president of Nationalist China.

Electrical World's address was forwarded to me from our local newspaper as an article appeared in it regarding bullet-proof glass, which is supposed to be much lighter than the one on the market.

I am interested to find out in what thickness this particular glass is manufactured and how much it weighs per square foot, also if it will stop a bullet from a 30 cal rifle or equal. If available could the cutting be done locally? And also what is the approximate price per square foot.

Maurice Schwartz

Coach Builders,
Pasadena, Calif.

• Body builder Schwartz was apparently referring to an article on Page 44 of the March 30 issue describing plastic street light globes that bullets don't shatter—but that doesn't stop them either. They go right through. Our ballistics editor, having a minute to spare, found out that bullet-resisting glass comes in thicknesses up to 3 in., weighing up to 39.2 lb per sq ft and in sheets as big as 30 x 72 in. Such a sheet 3-in. thick costs about $560.

A Full-Time Job

To the Editor:

I have before me a copy of the May 11 issue of ELECTRICAL WORLD and note, with interest and pleasure, the articles on pages 28 and 29, bearing on the Quad-Cities activity and the Chicago Electric Association's latest effort to promote adequate wiring. In the latter case, I note that Leonard Ewald is listed as chairman of the Chicago Adequate Wiring Committee. This is not a fact, because H. C. Moses holds that office. Len Ewald is with the association full-time in charge of their wiring program.

O. C. Small
Manager

National Adequate Wiring Bureau
New York City

230-v Air Conditioners?

To the Editor:

On page 142 of March 9 issue there is a brief statement on "Room Air Conditioners Need Adequate Wiring." This is correct. The first and most trying trouble with air conditioning equipment is the room unit, whether it is in a house or an office. My vote, if I may put it that way, is for 230-v units only. Then people cannot plug them in where the units have no chance of working.

Frank W. Chapman
Electrical Engineering Consultant
Greenwood, S. C.

Too Much Detergent!

To the Editor:

In your March 23, 1953 issue on page 152, you carried an item submitted by Cincinnati Gas and Electric Company relative to the automotive car washer, giving details of same.

I note that in the paragraph giving specifications, that it requires 10 oz of detergent to a car. This is apparently a misprint, as the requirements are only one oz to a washing.

A. J. Osborne

Acme Equipment Co.
Altoona, Pa.

Expert Writers!

To the Editor:

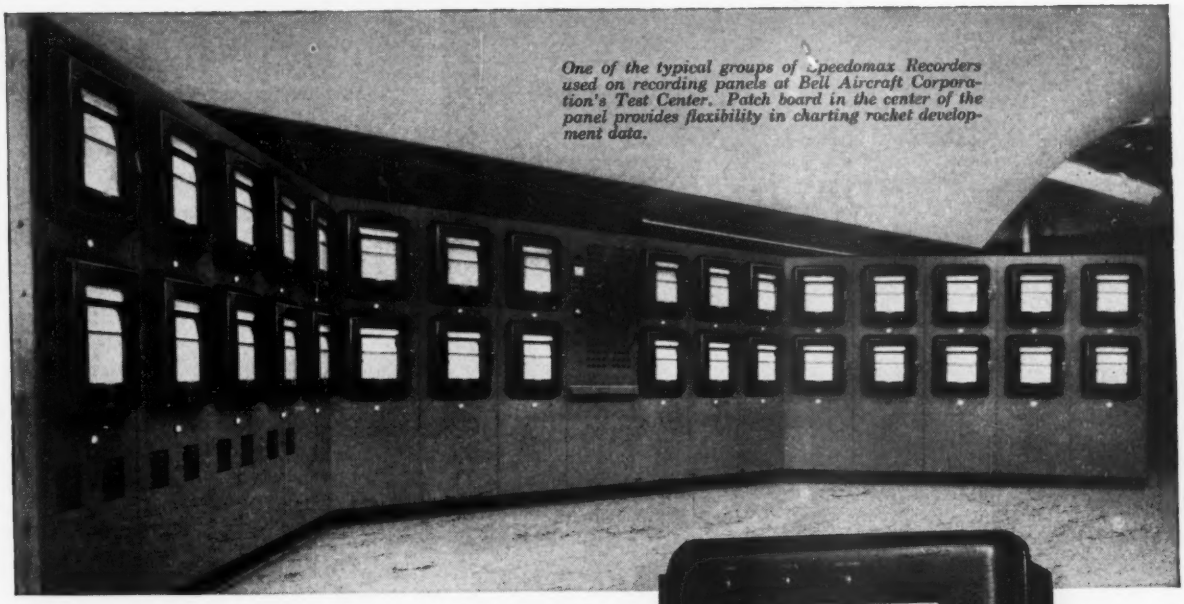
You may remember that some of us in Richmond wondered if the article on the One Line Diagram could be made interesting enough to justify its appearance in the Electrical World.

When the article appeared in the April 20 issue, we were delighted. Your expert writers had made my story into a real professional product.

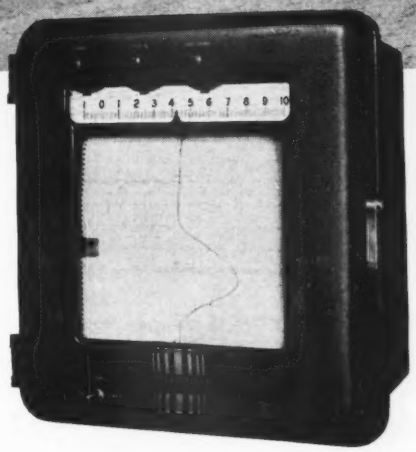
I hope the article will be a real help to many in our industry, and I appreciate very much your cooperation and encouragement while Fred Zak and I were trying to be writers.

F. W. Smith
Engineering Consultant
Virginia Electric & Power Co
Richmond, Va.

• These days Electrical World is making every effort to improve the writing and the appearance of all articles which go on its pages. The goal is to make it easier for our readers to get the valuable information which these articles contain.



One of the typical groups of Speedomax Recorders used on recording panels at Bell Aircraft Corporation's Test Center. Patch board in the center of the panel provides flexibility in charting rocket development data.



Just set the knobs at top of instrument for the desired range and zero, and this AZAR recorder is adjusted to your exact specs . . . spreads any millivolt value from one to twenty across the full chart width, for measuring Force, Weight, Temperature, Speed, Voltage or any condition which yields an electrical recorder signal.

COMPLEX ROCKET-TESTING ROUTINES

Simplified

by Speedomax® adjustable-zero adjustable-range Recorders

● Rocket engine development at Bell Aircraft Corp., of Buffalo, N. Y. involves several unique instrument requirements. The nature of rocket combustion problems demands highly versatile instruments . . . instruments that can be dial-set to meet a wide variety of new test conditions. Furthermore, the instruments must also simultaneously record a combination of motor parameters. The highly flexible Speedomax adjustable zero adjustable range (AZAR*) Recorder provides Bell with just the right instrument combination for speedy, accurate test results.

Data for use in the engineering, designing and testing of rocket motors are obtained from pressure, temperature, force and flow measurements. Electronic transducers provide a d-c voltage proportional to the quantity measured; this signal is relayed to the AZAR Recorders through the patching network located in the center of the panel.

Various types of primary elements are used because of the extreme ranges encountered. All recorders are read in millivolts and converted to the measured quantity during data reduction. Adjustment of the range and zero makes it possible to read any pre-selected portion of the instrument scale.

Duplicate information is relayed to remotely located consoles for the convenience of engineers at the test stands. This is accomplished by electrical signals fed from the retransmitting slidewires of the recorders. Jog pen (used at Bell for time correlation between machines) and other accessory features to meet individual requirements can be incorporated in the versatile AZAR Recorder.

A general description of this instrument is available, and will be especially useful if you can describe to us the nature of your recording problem. Contact our nearest office or write 4938 Stenton Ave., Philadelphia 44, Penna.

** L&N Trademark*

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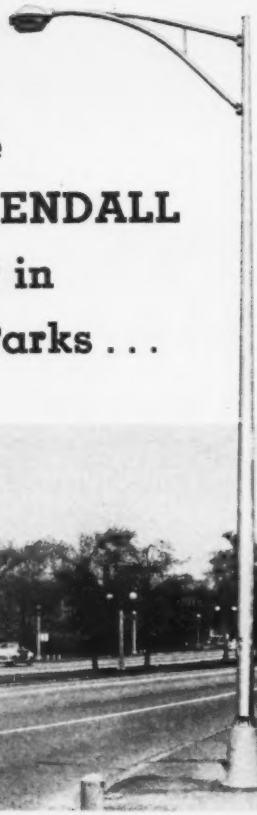
instruments automatic controls • furnaces

Jrl. Ad. EM9(4)



the PFAFF & KENDALL Story in Chicago Parks . . .

Special 28' tapered All-Aluminum standard with 8' overhead lighting upsweep arm on Lakeshore Drive, made to Chicago Park District specifications.

(Photo courtesy Chicago Park District)

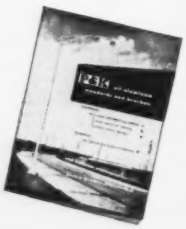
● **Nature's beauty now combines with the last word in functional, economical lighting standards in the parks of Chicago. Aluminum standards were first installed in May 1946 and as of February 1953, there were 700 in use. Pfaff & Kendall is presently producing approximately 1700 more for installation this year.**

WHY P & K ALL-ALUMINUM STANDARDS AND BRACKETS ARE ALWAYS THE *WISEST* INVESTMENT:

- ***Much lighter weight*** **means lowest installation cost**
- ***No painting required*** **means substantial, continuous savings**
- ***Negligible rate of corrosion*** **provides longest life**
- ***In event of knock-down salvage and re-use*** **is entirely practical**

Wherever P & K All-Aluminum standards are installed, up-to-the-minute lighting efficiency and lowest maintenance costs are assured.

Write for latest P & K catalog . . . and use the P & K planning and advisory services without obligation.



Pfaff & Kendall

84 Foundry Street
Newark 5, New Jersey

WHAT THEY'RE SAYING

At Industry Meetings

Questions and Answers

DR. KARL TAYLOR COMPTON, chairman of the Corp., Massachusetts Institute of Technology before the Diamond Jubilee, Case Institute of Technology at Cleveland, Ohio.

Who has the rights and what disposition is in the best public interest? Should the Federal government take over private property to develop a great hydroelectric power system or should power development be left to private enterprise? In hydroelectric power, or power from fuels, or atomic power we have the possibilities of doing some very fine things. We can create profitable employment. We can increase production of desirable things, reduce drudgery, create leisure for cultural and recreational pursuits, improve health, create security. The problem is how to organize and manage so that these good things result most surely and effectively.

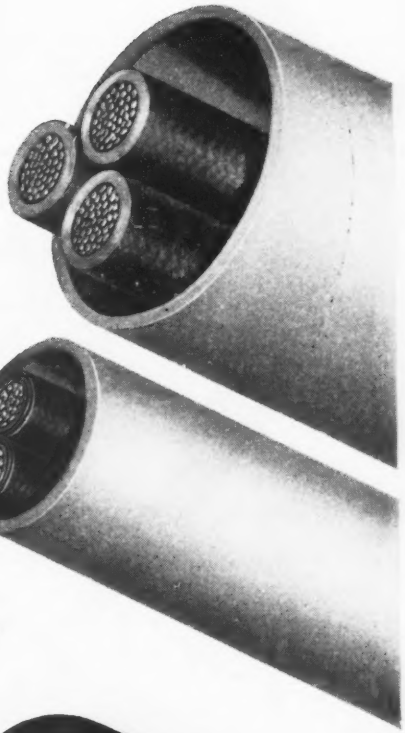
We want our nation to remain free, and we want to retain our individual freedoms in so far as this is consistent with the proper rights and interests of others.

What Will Computers Add Up To?

CLAUDE F SHANNON, Bell Telephone Laboratories before the Diamond Jubilee, Case Institute of Technology at Cleveland, Ohio.

Most of us are familiar with the adding machines used in banks and laboratories for ordinary calculations. Large-scale computers differ from these because they are enormously faster, an electronic computer can add two numbers in one ten-thousandth of a second. In a half hour it can perform calculations which would require a methematician with a desk computer a year to complete. They also have large internal memories in which they can store data concerning the problem, intermediate results of calculations and final answers. Finally and perhaps most important, the machines are programmed. This means that it is possible to write out in advance a long series of instructions telling the machine what to do. When this set of instructions, is fed into the

LOAD FOR LOAD!



ROCKBESTOS A.V.C.®

(N.E.C. TYPE AVA)

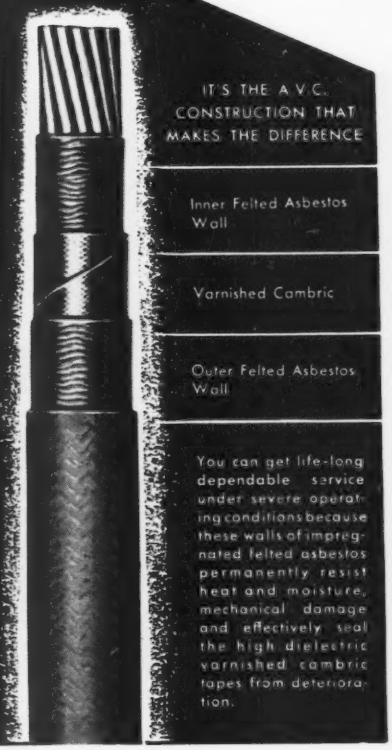
COSTS LESS INSTALLED

For example, take a 430 ampere load at 40°C Ambient temperature. To use type RH cable, an 800 MCM is required but with Rockbestos A.V.C. (AVA), a size 500 MCM cable carries the same load and is 38% smaller.

Three 800 MCM type RH cables requires a 4" conduit, while with Rockbestos A.V.C. (AVA), a 3" conduit does the job. What's more, the quicker, easier handling of lighter-weight Rockbestos A.V.C. (AVA) reduces labor costs substantially.

Compared size for size, Rockbestos A.V.C. (AVA) helps you increase capacity simply by rewiring old conduits. No new larger conduit, fittings and accompanying labor are needed.

To get the full story on the practical advantages of Rockbestos A.V.C. (AVA) high ampere cable—write for the booklet "—Cut Cable Costs."

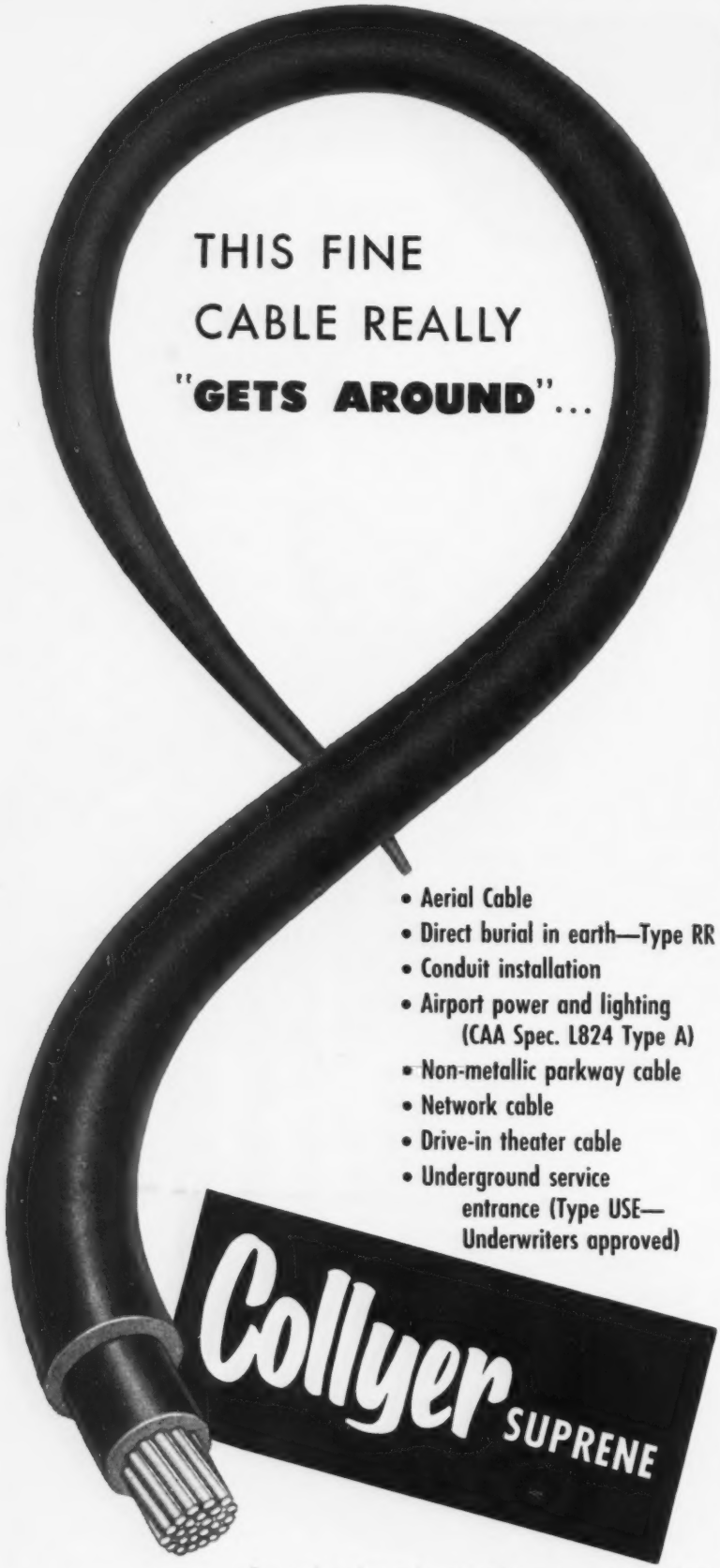

IT'S THE A.V.C. CONSTRUCTION THAT MAKES THE DIFFERENCE
Inner Felted Asbestos Wall
Varnished Cambric
Outer Felted Asbestos Wall
You can get life-long dependable service under severe operating conditions because these walls of impregnated felted asbestos permanently resist heat and moisture, mechanical damage and effectively seal the high dielectric varnished cambric tapes from deterioration.

ROCKBESTOS PRODUCTS CORPORATION

NEW HAVEN 4, CONNECTICUT

NEW YORK • CLEVELAND • DETROIT
CHICAGO • PITTSBURGH • ST. LOUIS
LOS ANGELES • NEW ORLEANS
OAKLAND, CALIFORNIA • SEATTLE

Hi® ...Your best buy


THIS FINE
CABLE REALLY
"GETS AROUND"...
• Aerial Cable
• Direct burial in earth—Type RR
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Collyer SUPRENE

For samples, prices, and recommendations, write Collyer Insulated Wire Company, 245 Roosevelt Avenue, Pawtucket, Rhode Island

machine, it faithfully carries them out, one by one, at extremely high speed. The instructions enable the machine to perform all the basic operations of arithmetic, addition, subtraction, multiplication and division and usually various other mathematical operations. The instructions enable the machine to store information in its memory and read it out at a later time. In addition, there are certain very important instructions which enable the machine to make a choice or decision between various lines of behavior. The choice is ordinarily determined by results that the machine will have available only when the time comes to make the choice. In other words, the machine makes a decision which the man who writes the program cannot exactly foresee, since he does not have the data available when writing the instructions.

Sweeping Changes in Steel?—No

CLIFFORD F. HOOD, president, U. S. Steel Corp before the Diamond Jubilee, Case Institute of Technology at Cleveland, Ohio.

As of now, we see no specific sweeping changes in industry as a result of the splitting of the atom. But who knows today what the developments of next week may be? If atomic power plants become the order of the day, sometime in the future, the steel industry undoubtedly will use them in common with other industries. Atomic energy as a source of heat for some few of the steel industry's metallurgical operations is conceivable—even a possibility. Obviously, this is something for the future. But the steel industry, even now, is exploring and using atomic by-products in some of its experimental programs and in some of its newer inspection devices. These developments will continue at an accelerated pace and will undoubtedly be extended into new fields.

Our industry is not unaware of the responsibilities that this places upon us and I believe that I can speak for the industry in saying that our expansion programs completed and in progress should eliminate any concern about an adequate supply of our products for the economy. But our anxiety is, as it is with atomic energy, whether our people and the people of the world will decide that our products are to be used for peace or war, for good or evil, for construction or destruction.

Build lines to stay with the CHANCE 8-Way

For best results, use the anchor that pushes *eight* blades into undisturbed earth all around the hole, with no wasted space between blades. This means complete, balanced load distribution.

Chance 8-way Anchors are available in a complete range of sizes from 60 to 200 square inches in area, for distribution or transmission line guying. Get full information today—consult your Chance Catalog—order from your regular supplier.

the CHANCE 8-WAY *gives full load distribution*

Anchor installations are *faster, easier* and *better* when line crews use the right tools. Chance tools are designed for efficiency and safety. The tools shown at right are what you need for expanding anchor installations.

1. Chance Combination Expanding and Tamping Bar. It hooks around the anchor rod and will not slip off.
2. Chance Telescoping Trip Auger—it bores like a bit, adjusts for various hole sizes, and has an easy dump trip.

Send for the Chance folder on the tools to use for better anchor installations.

You know it's RIGHT when you specify CHANCE

A·B·CHANCE CO·

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

ANCHORS • GUYING FIXTURES • LINE CONSTRUCTION TOOLS • CONDUCTOR CLAMPS
GROUNDING EQUIPMENT • HOT LINE TOOLS • HIGH VOLTAGE SWITCHES • CUTOUTS

C52-4A

Widest choice . . . *for engineered instrumentation*

EACH of the thousands of industrial processes presents its own peculiar problems of measurement and control. Naturally, no single instrument can solve all of these varied problems. Serious compromises would have to be made in performance, convenience, and cost.

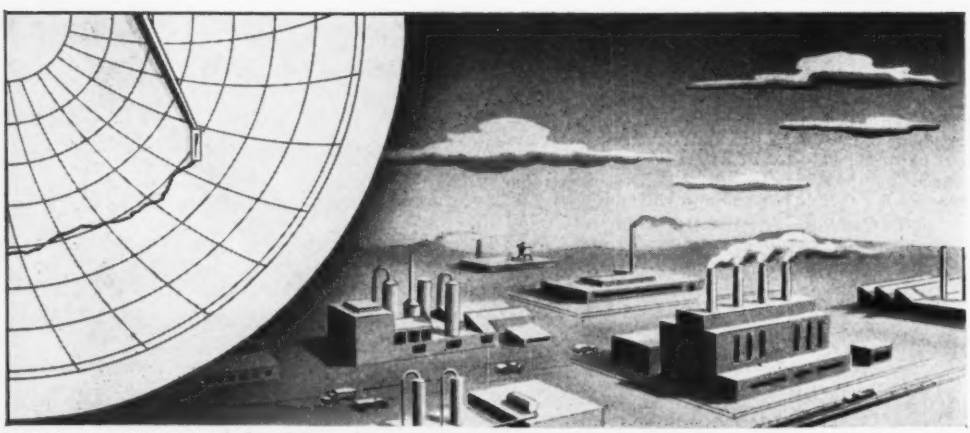
The many Honeywell primary elements, instruments, control systems, and final control elements constitute a uniquely complete family, covering practically the whole spectrum of industrial measurement and control. You can be sure that the combination selected for your job is recommended without bias, and with full consideration for every need of the application.

Included are *ElectroniK* instruments for indicating, recording and controlling a host of variables, in circular and strip chart models; *Tel-O-Set* miniature indicators, recorders and controllers; *Pyr-O-Vane* millivoltmeter controllers; square root and linear flow meters; thermometers; pressure gauges. Electric and pneumatic control systems range from the simplest to the most complex, including fully automatic program control. Primary elements include thermocouples, thermometer bulbs, *Radiamatic* elements, pH assemblies, conductivity cells, flow meter bodies and many others. For final control elements, there is a full range of motorized and diaphragm operated valves. Supplementing these are more than 7000 different non-indicating devices for controlling temperature, pressure, vacuum and other conditions.

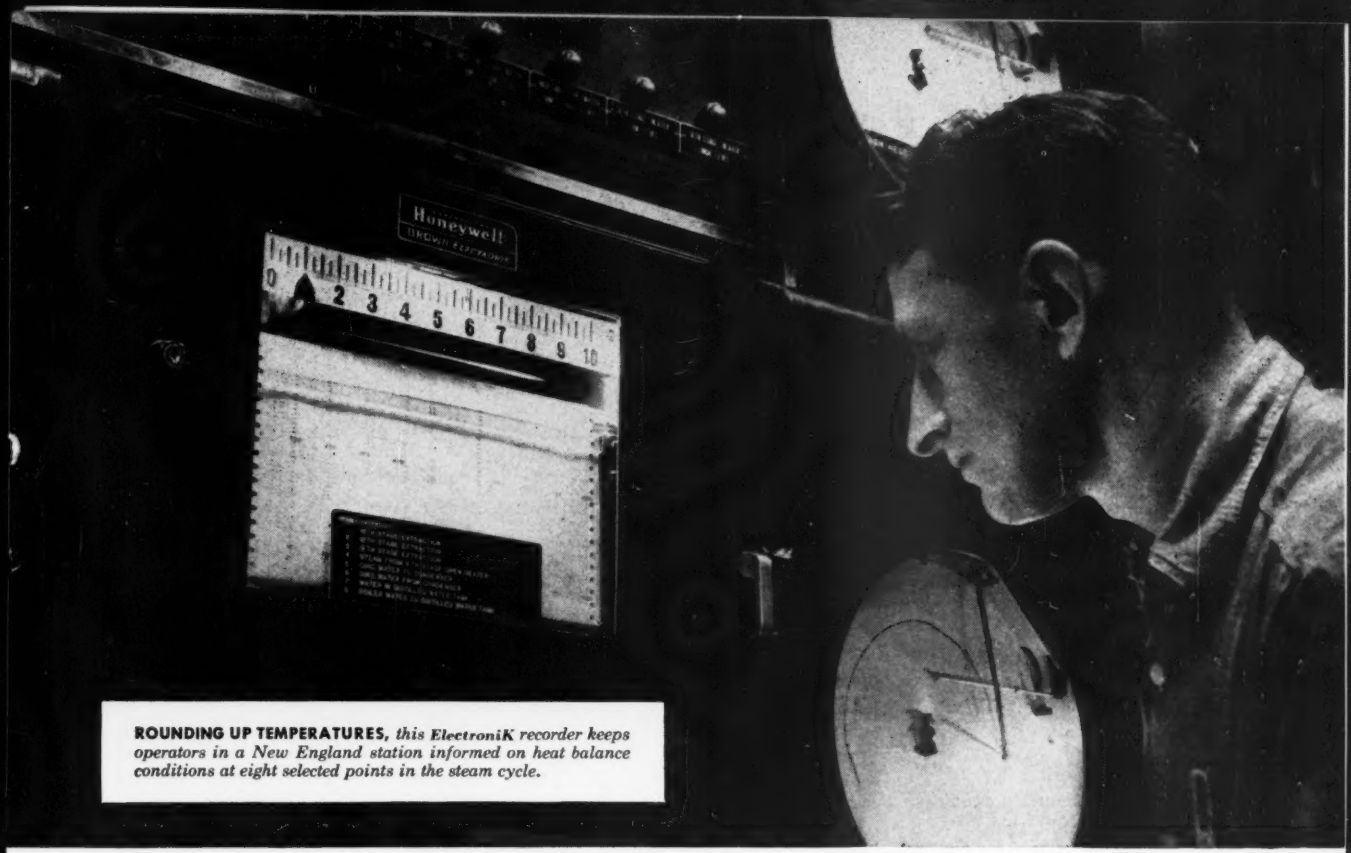
"Building block" approach

These are the building blocks of measurement and control. To combine them into systems custom-fitted to your process, Honeywell offers the know-how gained through years of experience in all branches of industry. Whether your process calls for a single instrument or a complete central control panel, you can be sure of getting the peak in performance and value . . . and the advantages of a single responsibility for the entire installation . . . when you specify *engineered instrumentation by Honeywell.*

Wherever *rely on*



COMPLETE COVERAGE *of industrial requirements for instrumentation is at your command in the Honeywell line. Whatever you need to measure or control . . . to any accuracy . . . with any of a variety of special features . . . you'll find Honeywell instruments offer the most efficient solution.*



ROUNDING UP TEMPERATURES, *this ElectroniK recorder keeps operators in a New England station informed on heat balance conditions at eight selected points in the steam cycle.*

measurement counts...

ElectroniK recorders

FOR ALL the vital measurements that are essential to power plant supervision, you'll get the most in performance with *ElectroniK* recorders. They have every feature that power engineers demand:

They're versatile: the same basic, industry-proved instrument is supplied for measuring temperature, frequency, power, flow, pressure, pH and conductivity. Single and multi-point models are available in a choice of printing speeds and chart speeds . . . readily equipped to operate signals and alarms.

They're accurate: built of life-tested, service-proved components, such as hermetically sealed converters, high-torque balancing motors, and simplified amplifiers. They're unaffected by vibration, atmospheric humidity or dust. They have earned a reputation for staying on the job week after week . . . month after month . . . without interruption.

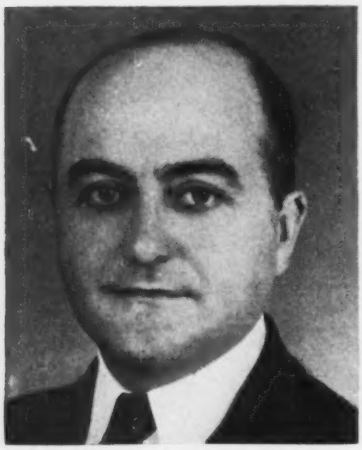
Behind these instruments stands the largest service organization of its kind, operating from more than 90 offices strategically located in the U. S., Canada, and throughout the world. Ask your local engineering representative for full facts . . . he is as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Penna.

● **REFERENCE DATA:** Write for Catalog 90-2, "Supervisory Instruments for Power Generation."

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

NEWS ABOUT PEOPLE



CHARLES E. EBLE

M. LeCOMPTE WARING

Con Edison Appoints 2 VPs

Consolidated Edison Co of New York, Inc, has announced promotions for five of its top officials.

Charles E. Eble, comptroller since 1946, has been elected a vice president, assuming responsibilty for taxes, auditing, and general accounting matters. M. LeCompte Waring, assistant vice president for the past four years, has been elected vice president in charge of production and operating departments.

Assistant VPs Named . . . C. Wesley Meytrott, since 1951 assistant general sales manager, has been designated assistant vice president of government contracts. J. E. McCormack, manager, outside plant construction department for the past year, has been made assistant vice president for production and operation. John V. Cleary, senior assistant comptroller since 1946, has been named comptroller to succeed Eble.

Boozer Assigned to New Post

HERMAN W. BOOZER

Herman W. Boozer, vice president and comptroller of Georgia Power Co, has been appointed vice president in charge of finance, a newly created post.

Georgia Power has also announced the following appointments: S. T. Grady, assistant comptroller, was promoted to comptroller.

Robert Wardle, Jr, assistant to the vice president and general manager, was made assistant to Boozer. W. A. Brown, general statistician, and H. B. Wansley, assistant plant accountant, were both named assistant comptrollers.

Operating Dept. Changes . . . R. O. Conwell, assistant operating manager, was advanced to assistant to the vice president and general manager. H. P. Whitehead, general superintendent of transmission and distribution, was named assistant operating manager.

A. H. Wade, system operator, was appointed superintendent of system operations. C. W. Lines was elevated from assistant system operator to system operator; and T. B. Cresswell, engineer, system operation, was made assistant system operator.

J. R. Carmichael, supervisor of purchases and stores, was named manager of purchases and stores, and W. H. Murray, assistant supervisor of purchases and stores, was designated assistant manager of purchases and stores.

Jack H. Murrah, Atlanta Division lighting engineer, was appointed sales supervisor of that division. His successor is J. E. Sweatte, architectural lighting specialist. Harry Yopp, lighting engineer, replaces Sweatte.

LOUIS G. GLESMANN

Revere Copper & Brass Names Three New VPs

Revere Copper & Brass, Inc, New York, has announced the election of three new vice presidents and two new members to the board of directors.

Louis G. Glesmann, who has been assistant general manager of the Rome (N. Y.) Division, was appointed vice president in charge of manufacturing with headquarters in New York.

The two other newly elected company officials are J. B. Buckley, who becomes vice president at the New Bedford (Mass.) Division, and Alexander N. Aird, who was named vice president at the company's Baltimore (Md.) Division.

The new directors are Raymond P.

Coming Up!

Steel for Electric Utilities

You can always be sure of fast action when you call Ryerson for steel. Sure that your requirements will get prompt, interested attention.

At each of 15 strategically located Ryerson plants experienced steel men who know the special needs of your industry are ready to work with you. And at Ryerson you draw on the most widely diversified stocks. Carbon steel, alloys, stainless—though it's still difficult to keep every size of every product always on hand, you will find we can take care of most every steel requirement.

You can have your steel cut to size, too, and you can always depend on Ryerson quality. So for every steel requirement, call your nearby Ryerson plant.

PRINCIPAL PRODUCTS

CARBON STEEL BARS—Hot rolled and cold finished

STRUCTURALS — Channels, angles, beams, etc.

PLATES—Many types including inland 4-Way Safety Plate

SHEETS—Hot and cold rolled, many types and coatings

TUBING — Seamless and welded, mechanical and boiler tubes

ALLOYS—Hot rolled, cold finished, heat treated. Also tool steel

STAINLESS — Stainless bars, plates, sheets, tubes, etc.

BABBITT—Five types, also Ryertex plastic bearings

RYERSON STEEL

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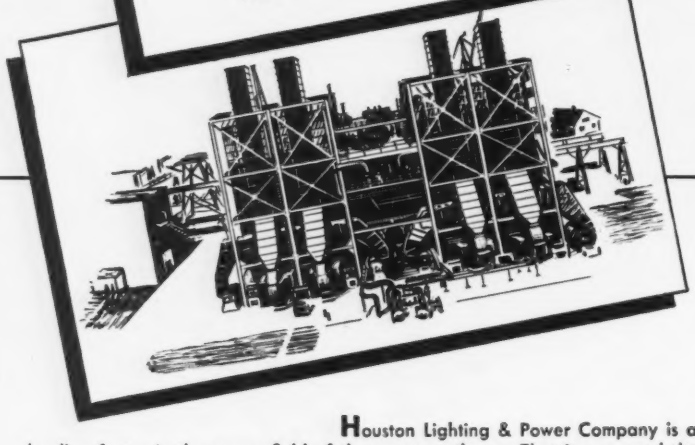
GO on GREEN

4 Green Forced Draft Fans
4 Green Induced Draft Fans
. . . Serve the West Junction Plant of Houston Lighting & Power Company



Houston Lighting & Power Company is a leading factor in the power field of the great southwest. That it approved the selection of Green Draft Fans by the boiler manufacturer — in this case Riley Stoker — is evidence of high acceptance in the field. No utility can afford to operate with inferior or unsuitable equipment at any point. It must have equipment that is not only highly efficient but right.

To Houston Lighting & Power can be added other well-known recently completed utilities that are Green Fan plants, among them the following:

Central Hudson Gas & Electric Co.
Atlantic City Electric Co.
Virginia Electric & Power Co.
Monongahela Power Co.
Louisiana Power & Light Co.
Kansas Gas & Electric Co.
El Paso Natural Gas Co.
Pacific Gas & Electric Co.
South Carolina Public Service Authority
Buffalo Niagara Electric Corp.

With utilities as with industrial power plants, it's safe to "Go on Green" when it comes to draft fans.

Our Catalog No. 168 tells all about Green Fans. Write for a copy.

THE GREEN Fuel Economizer COMPANY INC.
BEACON 3, NEW YORK

ECONOMIZERS • FANS • AIR HEATERS • CINDERTRAPS

Winberg, vice president at the firm's Rome Division, and Glesmann, new manufacturing vice president.

John C. Emison, assistant treasurer, has been made assistant secretary and assistant treasurer of Revere.

Other changes at Revere's Rome Division include the promotion of James A. Phillips to works manager. Carl O. Windrath to assistant works manager, Frederick C. Ludden to supervisor of methods, L. A. Jacobus to treasurer of the division, and Charles Getty to assistant treasurer.

GEORGE A. DONALD

Wisconsin Utility Group Elects Donald President

George A. Donald, president and general manager of Lake Superior District Power Co, has been elected president of the Wisconsin Utilities Association. Donald, who served the association last year as vice president, succeeds Theron A. Brown, vice president and general superintendent of Madison Gas & Electric Co.

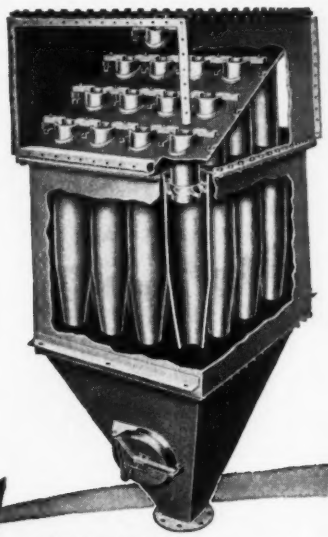
Harold P. Taylor, vice president and treasurer, Wisconsin Public Service Corp, was named vice president and Harold P. Chamberlin, assistant secretary and assistant treasurer, Wisconsin Electric Power Co, was re-elected treasurer.

Donald, a graduate of the University of Minnesota, joined Lake Superior District Power in 1920 as a storekeeper. After serving the utility in various posts, he was appointed president in 1951.

•

William A. Dittmer, Bonneville Power Administration power manager since

Before you buy *any* equipment for recovering fly ash . . .



COMPARE ALL OTHERS against MULTICLONE'S Multiple Advantages

Because the advantages of MULTICLONE are so clear-cut, so vitally important, so far-reaching in the savings they make, we urge you to make a factual unbiased comparison of MULTICLONE fly ash collection equipment against *any other* in the mechanical recovery field. Only by making such a comparison can you fully appreciate the major savings and greater performance you get by installing MULTICLONE Collectors!

COMPARE Recovery Efficiency!

It is a recognized fact that the separating efficiency of a cyclonic tube *increases* as the tube diameter *decreases* because smaller tubes generate greater centrifugal forces. The patented vane in the MULTICLONE makes the use of small tubes *practical* without complicated manifolding and permits compacting many small tubes into one simple, highly efficient unit. MULTICLONE's higher centrifugal forces throw out not only the large, medium and small particles, but also an unusually high percentage of the *extremely small* particles of 10 microns and less. Result—*more complete recovery of all suspended particles from the gas stream!*

COMPARE Space-Saving Compactness!

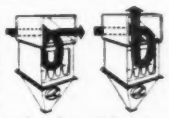
Plant space costs money—particularly at today's high construction costs. Because the MULTICLONE is more compact, size for size, it makes *really important* savings in space and plant costs. Note in the chart how the MULTICLONE requires substantially less space—*both in floor space and cubic space*—than any other unit of comparable capacity and performance. *This means vital savings in construction costs!*

Make	Relative Space Requirements in Sq. Ft.	In Cu. Ft.
Multiclone	1.0	1.0
Collector A	2.1	1.8
Collector B	5.9	3.2
Collector C	6.8	3.9

COMPARE Dollar-Saving Adaptability!

Savings in space is just one of many ways MULTICLONE reduces installation costs. Because the shape of the unit can be readily varied (long and narrow, short and wide, or square) to fit available spaces, the MULTICLONE can often be tucked into odd corners and waste areas too restricted for other equipment.

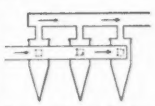
Moreover, inlet-outlet ducts can be varied—side-inlet side-outlet, or side-inlet top-outlet—to meet low headroom or restricted side clearance requirements . . . and the single-inlet single-outlet duct design permits greater flexibility and simpler installation. *These all add up to vital savings in installation costs!*



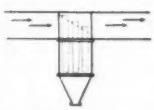
Side inlet, Side outlet *Side inlet, Top outlet*

COMPARE All-Around Simplicity!

The MULTICLONE is simple and inexpensive to maintain because there are no highspeed moving parts to repair or replace . . . no pads or filters to clean or renew . . . nothing to choke the gas flow or increase draft losses as suspended materials are recovered. In addition, the square, flat-sided shape of the MULTICLONE and its straight inlet and outlet ducts are far simpler to install and insulate. And since the recovered material from an entire bank of tubes is collected in a *single* hopper, it is much easier to service and maintain than the multiple hoppers of conventional cyclone units. *Here again, the MULTICLONE saves in many ways—all of them important!*



Conventional Cyclone



Multiclone

Whether your recovery installation is in a new structure or for modernizing present equipment, you will be far ahead by installing MULTICLONE Collectors. Our experienced engineers will gladly make helpful suggestions for simplifying your recovery problems. A letter, wire or call to our nearest office places this assistance at your service without obligation.

Send for Helpful Literature! This factual MULTICLONE literature explains the basic principles of cyclonic dust recovery and gives technical data helpful to anyone contemplating a dust or fly ash recovery installation. Write today for your free copy!

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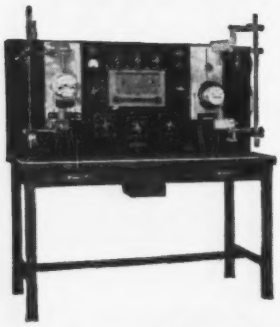

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SUPERIOR
SWITCHBOARD & DEVICES CO.
CANTON, OHIO
A subsidiary of The Union Metal Manufacturing Company

1940, has been named the new power manager for Kaiser Aluminum & Chemical Corp. Dittmer, who will remain with BPA for a time, will direct the work of seeking new sources of power supply for the Kaiser aluminum industry. His headquarters will be in Spokane, Wash.

Melvin C. Clemence, assistant to the manager of the Southern Division of Pennsylvania Electric Co since 1946, has been assigned to the post of system plant supervisor of the utility.

JOHN C. ELLIS

Ellis Is Appointed VP

John C. Ellis has been named vice president of Arrow-Hart & Hegeman Electric Co, Hartford, Conn. Ellis, who joined Arrow-Hart in 1945, was appointed in 1952 second vice president in charge of industrial control sales. Prior to assuming that post, he was manager of the Industrial Control Division.

Douglas D. Seely has been appointed vice president and secretary in charge of finance, accounting, and administration of the Fort Wayne (Ind.) Division of Bowser, Inc. Seely, who began his career with Bowser in 1927, was named secretary in 1951.

Raymond L. Witzke, Stewart E. Lauer, Jr, and **Charles A. Willer** have been appointed to posts in Westinghouse Electric Corp's new Atomic Equipment Department. Witzke, formerly an advisory engineer with the firm's industry engineering department in East Pittsburgh, was made manager of the industries atomic

power section. Lauer, who joined Westinghouse in 1951, was named purchasing agent for the department and Miller, with the company since 1939, was appointed manager of accounting.

William Brill, chief engineer for the Pueblo (Colo.) Plant of Colorado Fuel & Iron Corp, since 1950, has been appointed director of engineering for the corporation.

Walter E. Beckjord has been elected secretary of Cincinnati Gas & Electric Co to replace **George F. Brenner,** who has relinquished the post because of ill health. **Claude York,** who joined the utility in 1951, has been named assistant treasurer. Cincinnati G&E also elected Vice Pres **Darwin S. Brown** a member of the board of directors. Beckjord, a lawyer, formerly was associated with Peck, Shaffer & Williams, counsel for the utility. Brenner, affiliated with the utility for 35 years, has served as vice president and secretary since 1943.

Maynard D. Church, a consultant for Worthington Corp at its Wellsville (N. Y.) Works since 1946, has retired after 29 years' service with Worthington. Prior to assuming the consultant's post, he was a vice president for seven years.

Ivan Trottnow has been named manager of Central Iowa Power Cooperative, succeeding Ashley C. Knight, resigned. Trottnow formerly served as manager of Benton County Rural Electric Cooperative, Vinton, Ia., one of eight distribution systems supplied by Central Iowa Power. Succeeding Trottnow at Benton County is **John D. Ruehl,** former assistant manager of Greene County Rural Electric Cooperative, Jefferson, Ia.

John R. Heim, special representative at Morgantown for Monongahela Power Co, has been named safety director to succeed **Pearly M. Bower,** who is retiring because of ill health. Bower was appointed to the post in 1930.

Clarence E. Burke has been named general manager of the newly established high voltage switchgear department of General Electric Co's switchgear and Control Division. GE also appointed the following general

and so are pressure-creosoted poles!

● It is no problem to get dry, complaint-free pressure-creosoted wood poles. It takes creosote of proper specification for residue and proper pressure treatment. Your treater knows. He can treat wood with creosote so that it stays dry; and he is doing it every day. This is part of his constant effort to turn out an increasingly better and better product.

And remember . . . creosote is the *only* preservative that has kept wood sound and serviceable under severe conditions for more than 30 years.

Specify pressure-treatment with creosote for all *your* poles.

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The Performance-Proved Wood Preservative

Four-In-One
SPOOLS
For multiple service take-offs

REDUCE
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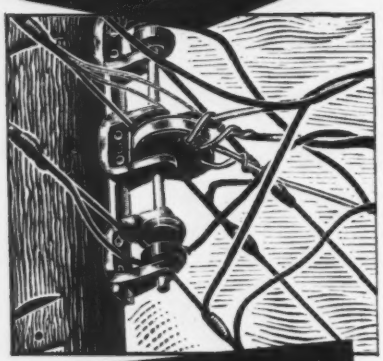

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LABOR COSTS

Engineered *specifically* for multiple service take-offs, Porcelain Products' Four-In-One Spools do *even more than* reducing shock hazard and saving labor. They save over a foot of conductor on each drop! They eliminate "feed backs" . . . reduce radio interference. They make possible even distribution of sag . . . permit service or secondary changes without one interfering with the other. They're a *practical* investment that will help your line and service crew.

Write for descriptive literature.

Porcelain Products, Inc.
FINDLAY, OHIO

managers for two other newly established departments of the division: **H. Frank Hentschel,** medium voltage switchgear department; and **Reginald H. Jones,** low voltage switchgear department. These departments replace the switchgear department, which has been discontinued. Appointed as managers of staff departments are **Vernon L. Cox,** engineering department; and **Edwin M. Bramwell,** financial department.

Corning Glass Announces Five Major Appointments

Corning Glass Works, Corning, N. Y., has announced five major appointments and the establishment of a new operating division.

John L. Hanigan has been elected vice president. He continues as general manager of CGW's Electrical Products Division, a post he has held since 1951.

Frederick H. Knight has been advanced from assistant secretary to secretary to succeed W. H. Curtiss, who continues as a director of the company and president of the Corning Museum of Glass. Henry H. Sayless, a member of the firm's legal department since 1951, has been made assistant secretary.

Thomas Waaland, manager of industrial relations since 1950, has been appointed director of industrial relations to replace Harry M. Hosier. Hosier, a vice president of CGW, was named industrial relations advisor.

Dr John F. G. Hicks, director of foreign technical service for the past six years, has been made general manager of the newly formed International Division, which consolidates all foreign activities of the company.

Benjamin Bennett, assistant secretary of West Penn Power Co since 1949, has been elected secretary of the utility to succeed **G. E. Murrie,** who has retired after 47 years' service. Murrie, who joined West Penn Power in 1906, assumed the post of secretary in 1926.

Lawrence A. Navarro has been assigned by Line Material Co, Milwaukee, to the new position of technical editor. Navarro, formerly a technical writer for Sperry Gyroscope Co, will be responsible for technical engineering data used in the firm's sales

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For Inverting D. C. to A. C. . . . Specially Designed for operating A. C. Radios, Television Sets, Amplifiers, Address Systems, and Radio Test Equipment from D. C. Voltages in Vehicles, Ships, Trains, Planes and in D. C. Districts.

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AMERICAN TELEVISION & RADIO CO.
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manuals, bulletins, and trade paper articles.

William H. Kopenhaver, assistant superintendent of Pennsylvania Power & Light Co's Sunbury Steam Electric Station since 1947, has been named superintendent of the company's new Martins Creek power plant now under construction along the Delaware River. He succeeds **Richard Forbes** who has been transferred to the office of superintendent of generation at Hazleton.

Louis E. Davis has assumed the post of director of purchases of Virginia Electric & Power Co. He formerly was assistant superintendent of production, in charge of steam-electric generating stations, and steam station design engineering supervisor.

Dravo Corp Elects 2 VPs

Two new vice presidents, a treasurer, and a comptroller have been elected by Dravo Corp, Pittsburgh. The vice presidents are John K. Beidler, general manager of the Machinery Division, and Louis P. Struble, Jr, general manager of the Keystone Division. Clifford A. Hill, formerly comptroller, was elected treasurer, and Edward T. Fitch was made comptroller.

OBITUARY

Junius LeRoy Dana, 82, who served General Electric Co for 46 years prior to his retirement in 1941, died April 29 at Cleveland. A pioneer and leader in the field of chemistry as applied to electric light bulb manufacture, Dana had served for more than 20 years as manager of the GE Lamp Division's chemical department. He joined GE's Packard Lamp Works at Warren Ohio in 1895, serving as an electrical and chemical engineer.

George E. Durban, 75, former special public utility representative of Frigidaire Division of General Motors Corp, died May 9 at Dayton, Ohio. Associated with GM for 32 years, Durban joined the public utility staff as a special representative in 1928, continuing in this capacity until he retired in 1949.

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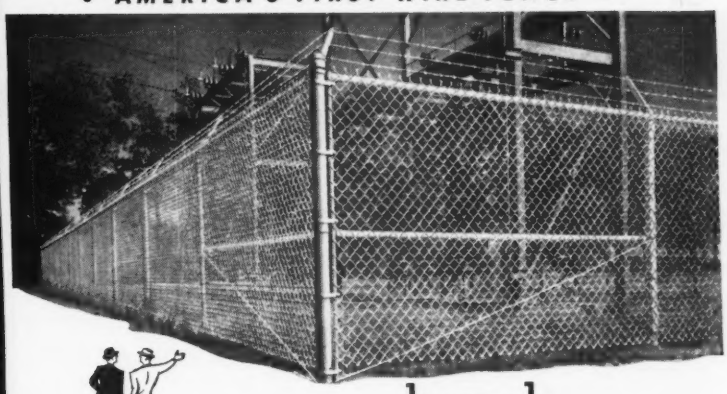

When you think of **hazards** think of PAGE, the pioneer name in fence protection for persons and property. Security is a job for Page Chain Link Fence, available in heavily galvanized Copper-Bearing Steel, rust-immune Stainless Steel or corrosion-resisting Aluminum. But this pioneer name means more than a quality product. It is a complete fence service, performed by more than 100 firms having technical training and fence erection know-how, and conveniently located throughout the country. For Page Fence data and name of firm nearest you—

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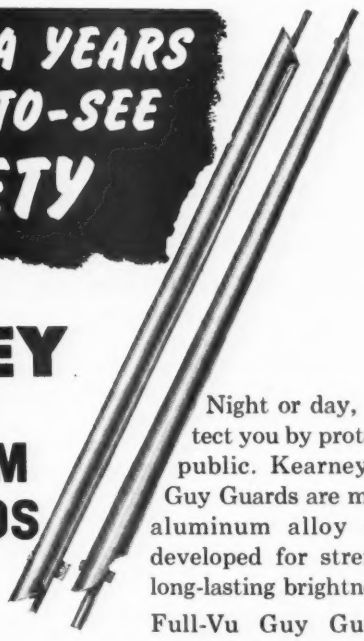

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Night or day, they protect you by protecting the public. Kearney Full-Vu Guy Guards are made of an aluminum alloy specially developed for strength and long-lasting brightness.

Full-Vu Guy Guards are available in a complete line of full-round and half-round seven and eight foot lengths.

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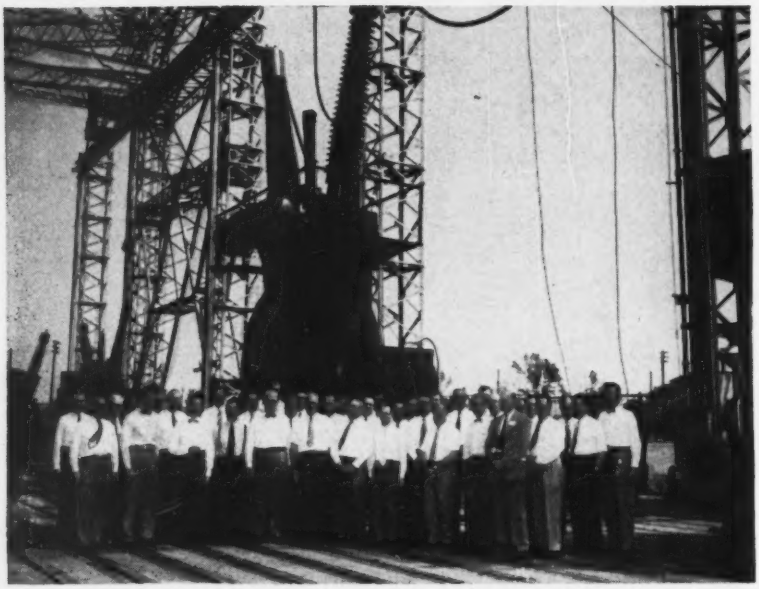

PEA Unit Sees 330-Kv Breaker Test

The General Electric Co 330-kv oil circuit breaker which towers over members of the Electrical Equipment Committee of the Pennsylvania Electric Association was demonstrated to the group on a recent tour of the company's new Switchgear Development Laboratory at Philadelphia.

PEA members witnessed a test at 30,000 amp on one pole of GE's first 330-kv breaker, which has an interrupting rating of 25 million kva. This is one of 32 breakers GE will supply Ohio Valley Electric Corp to protect the 330-kva transmission lines carrying power from two OVEC generating plants on the Ohio River to the Atomic Energy Commission's new $1.25-billion uranium diffusion center now under construction near Portsmouth, Ohio (EW, Feb. 16, p 15).

McKay Signs $3-Million Cable Contract with Alcoa

Bonneville Power Administration's plans for two ultrahigh 345,000-v "backbone" transmission circuits linking major load centers with new federal Columbia River dams now underway were assured May 18 as Secretary of the Interior Douglas McKay signed contracts with Aluminum Co of America totaling $3,985,000 for 1,327 mi. of 1.6-in. cable.

McKay noted the contract for nearly 17 million lb of steel-reinforced aluminum cable is one of the largest for high voltage conductor let by the government bureau.

The lines will link McNary Dam powerhouse with the J. D. Ross substation at Vancouver, Wash., for the Portland-Vancouver area and Chief Joseph Dam with Snohomish substation near Everett, Wash., in the Seattle-Puget Sound area.

Alcoa's Vancouver, Wash., plant manager E. D. Mairs reported the cable will be constructed in the company's newly expanded cable mill there. The contract was some $100,000 under low bid of $4,078,784 reported in April and Mairs said this resulted from deletion of a minor phase of the BPA proposal. Cable delivery is scheduled to start in 1954. First two McNary generators are slated to start turning Dec., 1953; Chief Joseph schedule calls for three in Sept., 1955, and a fourth in December.

British Concern Wins Seattle Cable Contract

The City of Seattle has awarded a $103,127 contract to the W. T. Henley Telegraph Works Co of England for 67,000 ft of lead covered paper insulated cable to be used by City Light.

Following U. S. firms submitted the next lowest bids: Chase Brass & Copper Co, $149,415; and Simplex Wire & Cable Co, $153,449.

"The city will pay duty on the cable amounting to 17½%, but even allowing for the duty we will be making a substantial savings for the lighting department," said Paul R. Hendricks, city purchasing agent. The cable will be shipped from England sometime in June.

This is the second contract awarded to a British firm for City Light supplies. Last December the English Electric Export & Trading Co received a $691,620 award for transformers.

Harlan Electric Submits Low Bid for Detroit Unit

Four consulting engineers are studying bids for installation of a 50,000-kw steam turbo-generator in the Mistersky power station of Detroit Public Lighting Commission.

Harlan Electric Co, Detroit, has submitted the low bid of $1,296,000. However, Brown Boveri Corp, Switzerland, will supply the generator, which will be installed by the Detroit firm if the bid is accepted.

Other bids came from General Electric Co, $2,900,500; Allis-Chalmers Manufacturing Co, $1,986,907; and Westinghouse Electric Corp, $1,946,500. Each of these bids carried an escalator clause of 20% to cover un-

MANUFACTURERS' EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Anaconda Copper Mining	3	Mar.	$8,100,501	$11,050,014	$ .93	$1.27
Cornell-Dubilier Electric	6	Mar.	895,000	736,000	1.85	1.50

foreseen labor and material increases. No conditions were attached to the Harlan bid.

Station Alterations?? . . . Because facilities already built into the Mistersky station are not large enough to accommodate the Brown Boveri generator, there are no assurances that the low bid will be accepted. A city official who declined to be identified estimated that alterations which would be necessary before the Swiss generator could be installed would run as high as $200,000.

The new unit will produce about half the electricity used in Detroit's public lighting. Work on the $8.5-million addition to the Mistersky station will begin in about a year and completion is set for early 1956.

A. B. Chance Co buys W. N. Matthews Corp

W. N. Matthews Corp, St. Louis, has been purchased by A. B. Chance Co, Centralia, Mo. This announcement was made by F. Gano Chance, president of the Centralia firm.

The Matthews organization, which manufactures split bolt connectors, cutouts, fuse links, and switches, will be known as the W. N. Matthews Division of the Chance company. Claude L. Matthews, formerly president of the St. Louis concern, has been named a vice president of the A. B. Chance Co. Matthews is donor of the Claude L. Matthews Valor Award.

The Chance firm has an assembly plant in San Francisco in addition to the main plant at Centralia. The Matthews Division has a new plant in St. Louis.

Refined Copper Stocks Decrease During April

Stocks of refined copper held in the United States by members of the Copper Institute, Inc, at the end of April totaled 48,382 tons, a decrease of 7,425 tons below the 55,807 tons held on March 31.

During April deliveries to domestic fabricators increased to 142,282 tons compared with deliveries of 133,462 in March. Refined production rose to 112,660 tons from 112,016.

Outside the United States refined stocks amounted to 146,974 tons on April 30, an increase of 13,707 tons

Bullets, stones, rough handling won't shatter the only one-piece plastic street light globe

Breakage problems and high maintenance costs are practically eliminated now that you can install the new Colt one-piece non-shatterable street light globe. And you lose nothing in efficiency, because this modified acrylic resin globe has light diffusion and transmission properties equal to those of any glass globe.

Detroit Edison, Public Service of New Jersey, and Potomac Electric Power Company have already tested the Colt globe, found it ideal for installations with a light output up to 6,000 lumens. Because it weighs only 2 lb. 3 oz., they found it exceptionally easy to clean with regular detergents. Colt globes showed no tendency to discolor or darken after the two-year test.

Maintenance crews like the Colt globe. It's easy to install, rarely needs replacing.

Find out for yourself how you can save money on street light globes. Send the coupon today for full information about Colt's non-shatterable globe.

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SEND COUPON FOR MORE INFORMATION

Colt's Manufacturing Co., Plastics Division, Hartford 15, Conn.

Please send me more detailed information on the new Colt Globe.

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City..... Zone..... State.....

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EVERSTICK ANCHORS...

EXTRA Holding Power
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AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

above the 133,267 tons on March 31. April deliveries dropped to 63,215 tons from 71,420 in March and refined production was 100,101 tons compared with 104,926.

MANUFACTURING BRIEFS

General Electric Co's application for the rezoning of 315 acres at Vallhalla, an unincorporated hamlet in Westchester, N. Y., has been approved by the Mount Pleasant (N. Y.) Town Board. This action paves the way for GE to construct a national headquarters for up to 1,500 executives and aides who now operate from New York City.

Triangle Conduit & Cable Co, Inc, New Brunswick, N. J., will sponsor a professional women's golf tournament slated for July 2-5 at Shackamaxon Country Club, Westfield, N. J. The tournament, to be known as the Triangle Invitational Round Robin Tournament, will be an annual affair and will attract the nation's top-ranking women professionals—such as Patty Berg, the Bauer Sisters, Louise Suggs, Betsy Rawls, and Betty Dodd. They will compete for a purse of $7,500, which will be donated by Triangle Conduit & Cable.

Construction of a modern one-story block long building will be the principal feature of a new $1-million building and plant rearrangement program undertaken by Sangamo Electric Co, Springfield, Ill. The new structure, 140 ft wide and extending the entire length of the factory, will provide a working space of 75,000 sq ft. Work on the new unit will be started this month and it is expected to be completed by December.

MEETINGS CALENDAR

Public Information Program
Steering Committee, Hotel Traymore, Atlantic City, N. J., June 1; Mid-Atlantic Region, Safe Harbor, Pa., June 16; Workshop Conference Committee, Blackstone Hotel, Chicago, June 23; Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

Edison Electric Institute
21st Annual Convention, Convention Hall, Atlantic City, N. J., June 1-4; Hydraulic Power Committee, Multnomah Hotel, Portland, Ore., June 15-16.

National Association of Electrical Distributors
Spring Meeting, Pacific Zone, Hunting-

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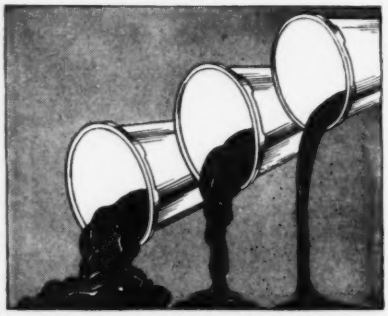

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ton Hotel, Pasadena, Calif., June 8-10; Fall Meeting, Pacific Zone, Hotel del Coronado, Coronado, Calif., Oct. 11-14.

California Municipal Utilities Association
Annual Conference, Clift Hotel, San Francisco, June 9-12.

New England Meter Engineers
General Electric Co.'s Meter Plant, West Lynn, Mass., June 12.

American Institute of Electrical Engineers
Summer General Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 15-19; Pacific General Meeting, Hotel Vancouver, Vancouver, B. C., Sept. 1-4; Middle-Eastern District Meeting, Daniel Boone Hotel, Charleston, W. Va., Sept. 29-Oct. 1; Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

American Welding Society
Exposition held in conjunction with National Spring Technical Meeting, Shamrock Hotel, Houston, Tex., June 16-19.

Wisconsin Utilities Association
Accounting Section Convention, Schwartz Hotel, Elkhart Lake, Wis., June 21-23; Sales-Service Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Michigan Electric Association
Annual Meeting, Mackinac Island, Mich., June 21-24.

Canadian Electrical Association
Annual Convention, Manoir Richelieu, Murray Bay, Que., June 25-27.

American Society of Mechanical Engineers
Semi-Annual Meeting, Statler Hotel, Los Angeles, June 28-July 2; Fall Meeting, Sheraton Hotel, Rochester, N. Y., Oct. 5-7; Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

Electrical Equipment Representatives Association
Summer Meeting, Hotel Colorado, Glenwood Springs, Colo., July 15-17.

International Association of Electrical Leagues
18th Annual Meeting, Fairmount Hotel, San Francisco, Aug. 5-8.

Northwest Public Power Association
Accounting Section, Monticello Hotel, Longview, Wash., Sept. 17-18.

Maryland Utilities Association
Fall Conference, Cavalier Hotel, Virginia Beach, Va., Sept. 18-19.

Rocky Mountain Electrical League
50th Annual Fall Convention, Broadmoor Hotel, Colorado Springs, Colo., Sept. 20-23.

Instrument Society of America
8th National Instrument Exhibit, Sherman Hotel, Chicago, Sept. 21-25.

International Association of Electrical Inspectors
Silver Jubilee Meeting, Edgewater Beach Hotel, Chicago, Sept. 21-26.

National Electrical Industries Show
Sponsored by Eastern Electrical Wholesalers' Association, 69th Regiment Armory, New York, Sept. 29-Oct. 2.

Interstate Power Club
Hotel Martinique, New York, Oct. 5; Hotel Martinique, New York, Dec. 7.

Electric League of Western Pennsylvania
4th Industrial Electric Exposition, William Penn Hotel, Pittsburgh, Oct. 6-8.

***Association of Edison Illuminating Companies**
Annual Meeting, The Greenbrier, White Sulphur Springs, W. Va., Oct. 8-10.

Iowa Utilities Association
Management Conference, Hotel Fort Des Moines, Des Moines, Oct. 12-13.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

Southeastern Electric Exchange
General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 4-6.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

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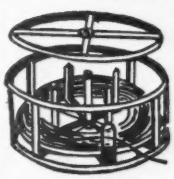

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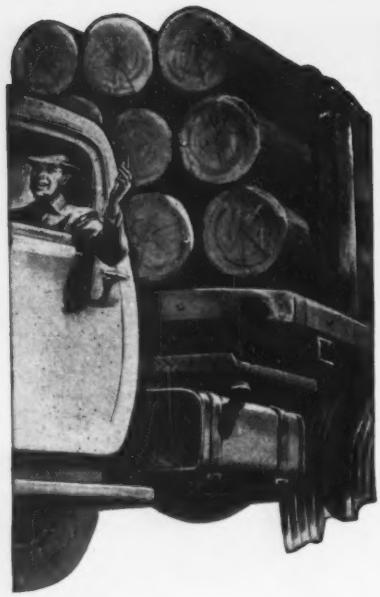

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AEC Plan: Release the Atom

(*Continued from page 67*)

submarine "Nautilus." The AEC announced in March that this plant had begun limited operation at its National Reactor Testing Station in Arco, Idaho.

But power companies are even more interested in another contract Westinghouse now has with AEC. This is for a reactor of a size large enough (100,000-200,000 kw) to power an aircraft carrier. A power plant of that size has more meaning to the power companies than the smaller submarine reactor. So industry leaders pricked up their ears recently when they heard that the Eisenhower Administration planned to curtail the project.

Atomic Equipment . . . The company, however, has already worked up enough confidence in the future of atomic power plants whether they drive ships or supply cities with electricity, to break ground for an atomic equipment plant to supply government and commercial needs.

General Electric also is at work on design of a submarine propulsion unit for AEC—this one to be built within a huge all-steel safety sphere near Schenectady, N. Y.

But GE does not share the belief that the atomic power age is already upon us. Harry A. Winne, vice president-engineering, who has been in charge of GE's atomic work, says he does not believe atomic power plants will be on the line in significant quantities for another 15 years. But he's not pessimistic of the prospects for nuclear development. He pointed out recently that estimates for first costs of reactors has dropped from $10,000 per equivalent electrical kilowatt in May 1950 to an $500 to $600 today.

"That $600 is a long way from $100," he said, "but isn't it encouraging to note how rapidly the estimated cost has dropped?"

Look to Washington . . . Those in the electrical industry—both utilities and manufacturers—have indicated they are ready to go into the atomic energy business. The Atomic Energy Commission and the President have expressed their readiness to give business men a chance. But Congress must decide whether the act is to be changed, so the whole business hangs on Congressional actions in the weeks to come.

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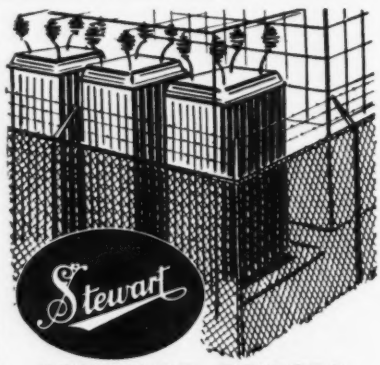

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MEETING REPORT

Overloading . . .

. . . of transformers discussed at meeting of PEA Electric Equipment Committee

Increased interest rates on new capital may force overloading of substation transformers fully as great as Defense Electric Production Administration requirements of recent years, A. F. Phillips, Duquesne Light Co, told members of the Pennsylvania Electric Association Electrical Equipment Committee at Philadelphia recently. Overloading if not overdone can mean vast savings in capital investment and lesser savings in maintenance.

Factors Determining Capability . . . Phillips cited the five factors for determining transformer capability as

1. Air temperature.
2. Load factor.
3. Forced air cooling.
4. Higher emergency temperature.
5. Emergency load transfer.

He advocated holding in reserve either the forced air cooling or emergency load transfer to offset maintenance, abnormal load growth, and delays in building relief capacity. But full utilization of the remaining four factors permits high ratings with acceptable winding life, he said.

L. J. Gill, Pennsylvania Power & Light Co, stated that its normal practice has been to permit emergency overloading. Studies proved that typical weather and load conditions would permit up to 180% of nameplate loading in winter.

Emergency ratings should be specifically restricted to loading caused by system failures, advised B. R. Nevins, Philadelphia Electric Co. While calculations assume increased hot-spot temperatures, they should properly evaluate repair or replacement time to restrict life sacrifice to 5% per emergency.

Consensus of the panel was that loading in accordance with the American Standards Association Guide has become an established practice.

Bigger Units . . . Continued climb in the size of generating units capable of integration into the Philadelphia Electric system was foreseen by Vice Pres R. P. Liversidge. He outlined

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the development of Cromby Station with a 150-Mw unit in 1954 followed by a 200-Mw in 1955. Then a new site will be started with a 250-Mw unit.

The advantages of the magnetic amplifier excitation system for generator voltage control were presented by J. E. Barkle, Westinghouse Electric Corp. Among those stated were inherent reliability, minimum dead band, improved rate of response, and zero time delay.

The appointment of E. L. Schlottere, Philadelphia Electric Co, to serve as vice chairman of the Engineering Section was announced. Schlottere was formerly chairman of the Electrical Equipment Committee.

Report on Atomic Studies Given at NJUA Meeting

Dow Chemical Co and Detroit Edison Co and their associates are proceeding with the feasibility development phase of their atomic project as rapidly as they can, declared Alton P. Donnell, before the recent spring meeting of the New Jersey Utilities Association at Absecon, N. J.

Donnell is coordinator of the Dow Chemical—Detroit Edison Nuclear Power Project.

"Looking to the future," he said, "if a flourishing private enterprise can be achieved in the atomic energy development, a tremendous advantage for the country would be gained. Thus enterprise would be adaptable to the production and utilization of fissionable materials required for both peacetime and military uses."

Purpose of the project, he continues, is to explore means of finding an economic industrial use for the atom as a source of heat energy and new fuels. A breeder reactor would be developed as an economic source of power. The Dow Chemical-Detroit Edison development program being carried out jointly with Atomic Energy Commission was estimated to cost about $1 million for the first year. Of this amount, Donnell said, AEC's development was approximately three-fourths of the effort, and company-supported work, one-fourth.

"If the technical problems can be resolved," he said "the two companies would like, as soon as possible, to build and operate a reactor plant of commercial size—using private capital and without recourse to government funds, guaranteed prices for reactor products, or subsidies of any kind."

GPU Conducting Studies on Network Analyzer

General Public Utilities Corp is conducting extensive studies on electric systems on the new "10,000 cycle" network analyzer at the University of Illinois.

The GPU system, which serves more than 2,700 communities in Pennsylvania and New Jersey, will be set up on the board, along with facilities of interconnected companies. Preliminary minimum studies call for setting up a total system of more than 170 stations including 30 GPU stations, involving 7,600 Mw.

The study later may be expanded to include other companies so that a total of 200 generating plants with a capacity of about 14,000 Mw would be reflected on the board. Such a possible expanded study would cover a major share of the Middle Atlantic Region and, it is hoped, would provide important information on operating advantages from even more extensive interconnections than now exist.

The study being conducted by GPU is believed to be the largest of its kind ever set up on a network analyzer. It also will be projected into the future farther than has been common practice in the industry. Load for the GPU system has been forecast up to 1970 and studies will be directed toward planning such a system which, based upon an average annual rate of load growth of more than 7% in the last 15 years, would by 1970 serve more than double today's load.

Faulty Stud Knocks Out 100,000-Kw Unit at Toledo

A 100,000-kw unit at Toledo Edison Co's Acme Station was shut down May 12 as a result of damage caused when a stud in the field winding of the generator disintegrated.

The rotor of the damaged unit has been shipped to Westinghouse Electric Corp's Pittsburgh plant for repairs.

There was no break in service to Toledo Edison customers when the accident occurred. Load was picked up by the station's other units and by Ohio Power Co.

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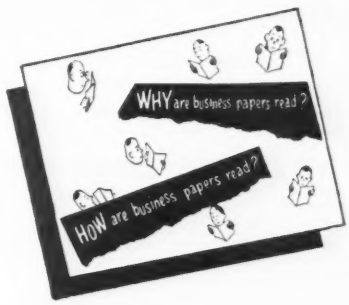

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HIGH CALIBER sales-manager with electrical and mechanical background call upon established clientele. Salary guaranty, plus commissions and expense for man with experience, willingness and ability earn attractive income. Headquarters Albuquerque, New Mexico, from 30 to 45, replies confidential. Box 602 Abilene, Texas.

SELLING OPPORTUNITY OFFERED

WANTED MANUFACTURER'S Agent to represent manufacturer of expanding guy wire anchors in North and South Carolina, Virginia, Georgia, Florida and Alabama. RW-7677, Electrical World.

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- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinary stocked by your regular supplier.
- Cut to length. Reasonably priced.

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WE BUY SURPLUS VALVES & FITTINGS

We want your surplus valves, flanges and fittings.

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LD 635 *Phone* 2-5228

FOR SALE

4—new and unused 2,000 KVA Westinghouse type CSP outdoor

TRANSFORMER UNIT SUBSTATIONS

Voltage 22,900/2400▲/4160Y
Air Circuit Breaker—50,000 KVA I.C.
5-5% Primary Taps
Load Tap Changer on Secondary
Complete unit assembly
Price (basis 1, 2, 3 or 4) $25,000 each, subject to prior sale

Mail or telegraph inquiry for add'l specs.

E. G. HICKS
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Phone: Rittenhouse 6-8086

FIBRE GLASS INSULATION

35 tons—new—Surplus ½", 2", 3" and 4". Fibre Glass Batts. 24"x36". Made to rigid Navy specs.

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PREsident 3-7100

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FS-8026, Electrical World
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BARGAIN

D.C.—EXCITER

50 K.W. Westinghouse exciter, 125 v. 400 amp. DC, 3600 RPM, compound interpole, Style 85C17, Ser. #4861636. Sgl. bearing, forced lubrication, cast iron base and coupling for turbine drive.

PHONE CANAL 6-2900

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Or are you looking for—or offering—a business opportunity of special interest to men in the industry served by this publication?

The solution of any of these problems can logically be found *first* among *other* readers of ELECTRICAL WORLD. You can get their attention—at small cost—through an advertisement in the Searchlight Section.

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	VOLTAGE
4	2500	Mol.	69000—13800
6	2000	G. E.	66000/114000 Y—2400
4	500	Pitts.	66000/33000—13200/23000 Y
4	500	West.	69000—6900
3	200	Pitts.	66000—2300
4	150	West.	44000/33000—2300/6900
6	100	G. E.	44000—2300
3	75	West.	44000—7200/12470 Y
6	25	G. E.	44000/22000—2200/480
4	5000	G. E.	40935/70900 Y—14500
3	5000	G. E.	38100/66000—6600
2	5000	West.	33000—26400, 3 ph.
4	500	G. E.	33000—7200/12470 Y
4	333	G. E.	33000/7200/12470Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	100	West.	33000—240/480 NEW
3	100	A. C.	33000—7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
6	2125	G. E.	26400/13200—2300
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000—13280/23000
6	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	5000	Pitts.	13200—4600, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	West.	13800—480/240
3	200	G. E.	13800—2300
3	150	Mol.	13200/22800 Y—2300/4000 Y
3	250	Pitts.	7200—220/440
3	100	G. E.	7200—240/480
3	75	G. E.	7200—240/480
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
2	250	West.	2300—460
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
4— 60 KVA West. 250/500 A. 2400 V. 1 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
8— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

CIRCUIT BREAKERS

2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

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TRANSFORMERS

FOR SALE

6—1000 KVA Mol. 11500—2400/4160Y
3— 500 KVA G-E 22000—2300/4000Y
3— 333 KVA W-H 6600—2300
5— 333 KVA Mol 7200/12470Y—2400/4160Y
3— 200 KVA G-E 22000—2300
3— 150 KVA G-E 44000—600/2400
3— 150 KVA G-E 19050/33000Y—2540/4000Y
2— 150 KVA G-E 6900—230/460
3— 100 KVA G-E 33000—6900/11950Y
3— 100 KVA G-E 13200—2300
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Many other items in stock.

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Reliable rewind and repair service on all makes of transformers

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CINCINNATI 27, OHIO
40 Years Dependable Service

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Q.	KW	Make	Rese.
1—	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1—	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—SurfaceCond.
1—	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1—	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter
1—	400	Westgh.	Non-Cond—125/150 lbs., 5/10 lbs. B.P., 240/480-3-60
1—	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60

FREQUENCY CHANGERS

KVA	Make	RPM	Voltages	Frequency
1—3750	G.E.	300	2400/4150—2400/4150	25/60/25
1—3125	G.E.	300	2400/4150—2400/4150	25/60/25
2—2500	G.E.	750	2400/4150—2400/4150	25/62½/60/24

MOTOR GENERATOR SETS
3 ph, 60 cy.

Qu	KW	Make	Speed	DC Volts	AC Volts
1—	2000	G.E.	514	600	6600/13200
2—	2000	G.E.	300	666 25 cy.	11000
1—	1500	C.W.	514	115	4000/13800
1—	1500	G.E.	720	600	13200
1—	1500	G.E.	360	275	2200/4400
3—	1500	G.E.	514	250	6600/13200
1—	1500	G.E.	600	600	2300/4150
1—	1000	G.E.	900	260	4100/6900
2—	1000	Whse.	900	600	2300/4150
1—	750	Whse.	900	275	2300/4150
1—	500	Whse.	900	250	6609/13200
1—	500	Whse.	1200	125/250	2300
1—	500	Whse.	900	250	440
1—	500	G.E.	720	125	2300
1—	400	G.E.	720	250	440/2300
1—	150	G.E.	1200	275	2300

TRANSFORMERS—60 Cycle

KVA	Make	Type	Ph	Voltages
1—2500	Whse.	OISC	3	26400/13200 x 480
3—1250	G.E.	HVDDJ		6600x2550
1—1150	A.C.	OISC		13200x480/2400
3—1000	G.E.	HVDDJ	1	2200/480

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IMMEDIATE SHIPMENT
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UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1980	Nordberg	TS-217	2800	225	320	Enterprise	D8G-6	560	450
1500	Fairbanks Morse	33E16	2000	300	300	General Motors	8-268A	460	1200
1136	Fairbanks Morse	38D	1600	720	250	Fairbanks Morse	37-E	375	360
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
500	Baldwin	VO-8	750	514	150	Buckeye	80	240	600
500	General Motors	8-278A	750	720	100	Worthington	BB-5	150	600
500	General Motors	8-567	720	720	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	8-S	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
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TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/480V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
3— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
2— 150 KVA Pitts., 1 Ph., 240V. 120/240V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM. 3 Phase 60 cyc., 2200V T E F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM. 220V. 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V. 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000V Syn.
1—1000 KW Whse., 275 V, 720 RPM, 4000 Syn.
1— 175 KVA West., 1Ph., 220V. Motor 3Ph., 400V.
1— 150 KW G.E., 126/250V. 1200 RPM. 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS

1— 400 H.P., West., CW, 450 RPM, 550V.
1— 250 H.P., West., CW, 600 RPM, 440V.
1— 200 H.P., West., CW, 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.
1— 100 H.P., G.E., MT 600 RPM, 440V.

Large Stock of A.C. and D.C. Equipment

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
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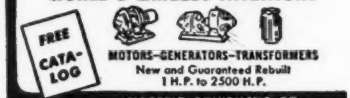
WORLD'S LARGEST INVENTORY



MOTORS—GENERATORS—TRANSFORMERS
New and Guaranteed Rebuilt
1 H.P. to 2500 H.P.
ELECTRIC EQUIPMENT CO.
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Complete Power Plant including distribution lines
Serving thriving Alaska City
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Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION
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Americans Are Rolling Up Their Sleeves!

YES, ALL KINDS OF PEOPLE ARE GIVING BLOOD SO THAT OUR WOUNDED MAY LIVE!

• Today, the blood of a Boston bookkeeper may be flowing through the veins of a wounded kid from a Kansas farm . . . the blood of a pretty Southern housewife may have saved the life of a grizzled leatherneck. For, blood is blood, a God-given miracle for which there is no substitute . . . and when a man's life hangs in the balance and blood is needed, there is nothing else to take its place!

Right now the need for blood is urgent. In hospitals —at home and overseas— many men require four and six transfusions during delicate operations. And the blood *must be there*—when it's needed. So give the most precious gift of all—*your* blood!

Be assured that giving blood is neither difficult nor distressing. And what a thrill there is in knowing that you've performed a really unselfish act! So call your local American Red Cross today and make an appointment. And tell your friends and neighbors about your experience. Let them share the wonderful feeling Americans get when they roll up their sleeves—and give blood.

But—

WHAT HAPPENED TO THAT PINT OF BLOOD YOU WERE GOING TO GIVE?

Call Your American Red Cross Today!

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he's working for you

THIS FELLOW IS TRAINED IN YOUR BUSINESS. His main duty is to travel the country — and world — penetrating the plants, laboratories and management councils . . . reporting back to you every significant innovation in technology, selling tactics, management strategy. He functions as your all-seeing, all-hearing, all-reporting business communications system.

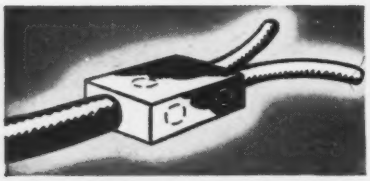
THE MAN WE MEAN IS A COMPOSITE of the editorial staff of this magazine. For, obviously, no one individual could ever accomplish such a vast business news job. It's the result of many qualified men of diversified and specialized talents.

AND, THERE'S ANOTHER SIDE TO THIS "COMPOSITE MAN," another complete news service which complements the editorial section of this magazine — the advertising pages. It's been said that in a business publication the editorial pages tell "how they do it" — "they" being all the industry's front line of innovators and improvers—and the advertising pages tell "with what." Each issue unfolds an industrial exposition before you — giving a ready panorama of up-to-date tools, materials, equipment.

SUCH A "MAN" IS ON YOUR PAYROLL. Be sure to "listen" regularly and carefully to the practical business information he gathers.

McGRAW-HILL PUBLICATIONS

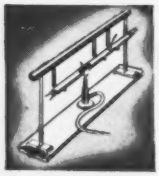
How to get longer life out of your portable cords and cables!



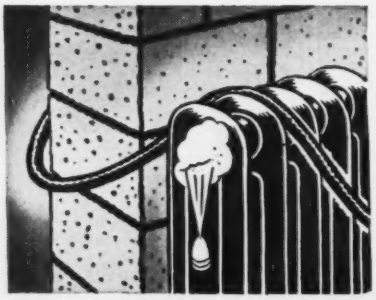
1 **USE** junction or distribution boxes for making multiple power connections in working places.

2 **PROTECT** cables with fuses or circuit breakers of the proper rating for the service. Make sure that circuit breakers will operate properly.

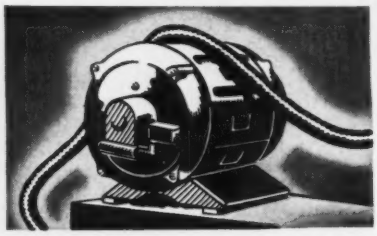
3 **PROTECT** cables from being run over by heavy equipment. Running over the cable a few times may not cause immediate failure, but may do internal damage which will shorten its life. If the cable must be run across an aisle, place boards on either side as one would for a hose. If it is in use for only a short time, it should be thrown over the truck.



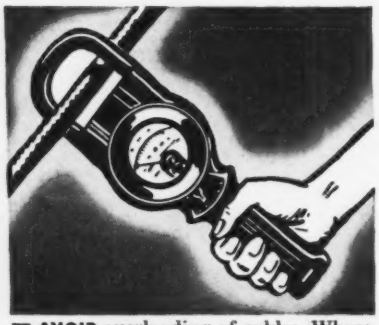
4 **USE** flame-resistant cables wherever possible.



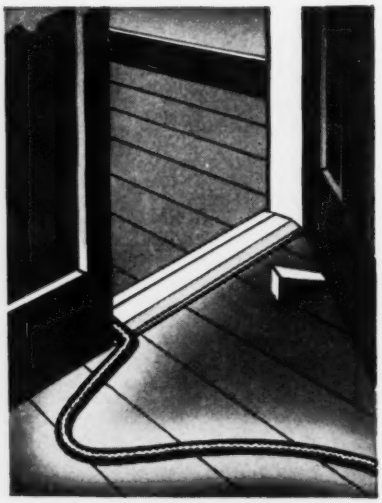
5 **DO NOT** have portable cords and cables running over steam pipes or other heat-transmitting equipment.



6 **KEEP** cables away from sparking motors and high voltage equipment. The ozone generated by sparking commutators attacks rubber jackets, causing cracking.



7 **AVOID** overloading of cables. Where possible, use I.P.C.E.A. recommended current ratings.



8 **AVOID** dragging portable cords around rough edges or sharp corners. Bruises and cuts hasten deterioration of the jacket. Never yank cords to remove kinks or loosen them when caught on a projection.

9 **AVOID** running portable cables on pulleys or drums too small for the size of the cable; observe recommended I.P.C.E.A. minimum diameters.

10 **KEEP** cords away from oils and greases. If they do get into oil, they should be wiped off as soon as possible. Avoid having cords lie in pools of water, chemicals or grease.

11 **BUY** cables that can carry the required current without overloading or overheating. They should be flexible (have sufficiently fine strands) for the intended use.

FOR FREE REPRINTS OF THIS PAGE, WRITE TO ADDRESS BELOW.

UNITED STATES RUBBER COMPANY

U.S.RUBBER
SERVING THROUGH SCIENCE

Electrical Wire and Cable Department

ROCKEFELLER CENTER • NEW YORK 20, NEW YORK

How Moisture is Kept Out of Transformer Coils

Fast sequence from drying oven into tank is one reason why you get consistently excellent insulation quality in Allis-Chalmers distribution transformers.

Here's How It's Done

Core and coil assemblies move continuously through the tunnel-type electrically heated oven partly shown in the background above. Then . . . immediately after the drying cycle is complete . . . they are immersed in dry oil in their own tanks. This prevents any absorption of moisture that might have occurred if the cooling had been done in air. Then a vacuum drawn on the transformer removes any air entrapped in the oil.

Finally, Production Line Impulse Testing

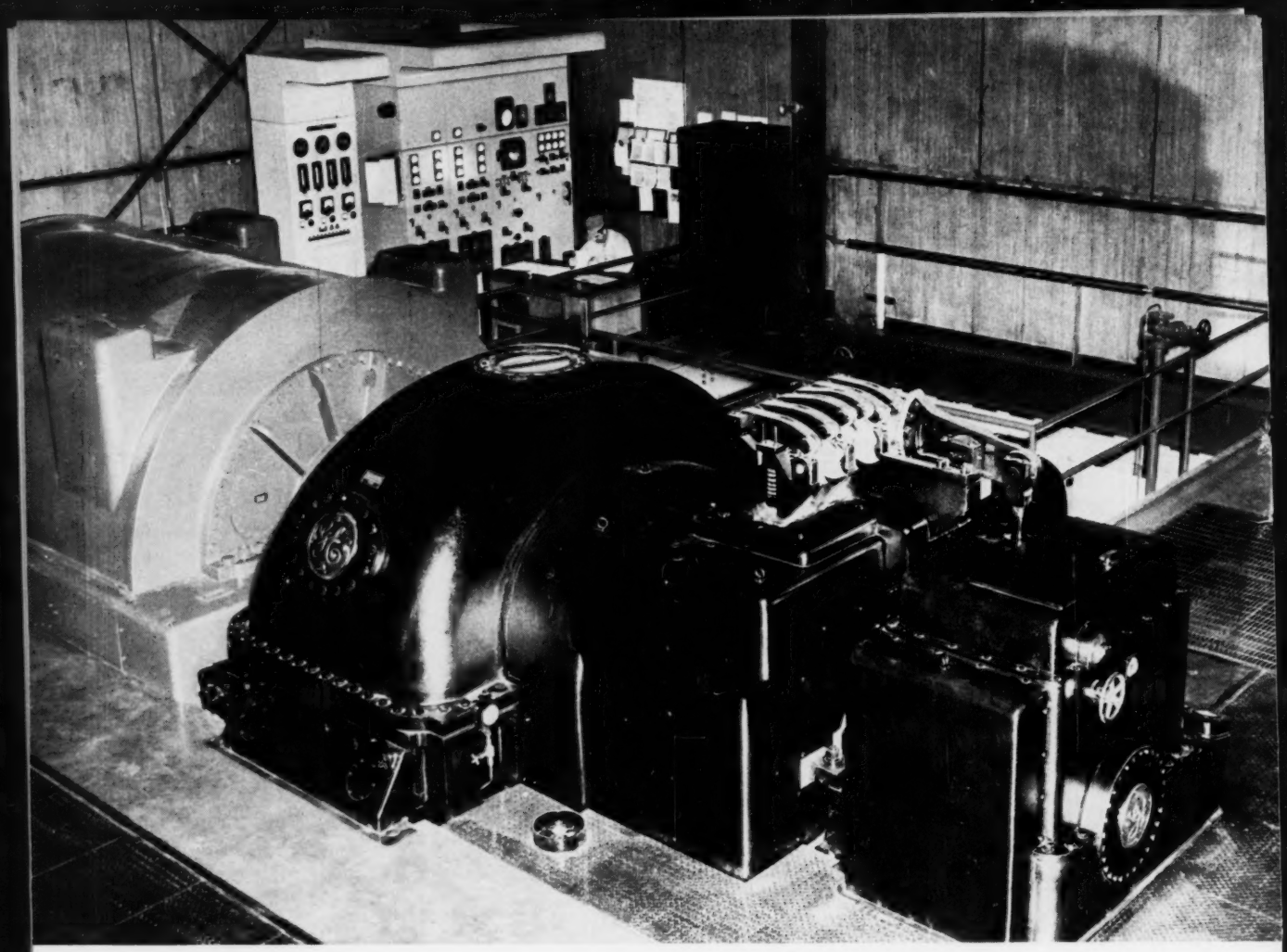
As a final step, production line impulse testing is used to assure uniform high insulation strength.

Get All Benefits

Careful attention to manufacturing detail is only one of the many reasons why you benefit when Allis-Chalmers distribution transformers are on your system. For complete information, call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wis.

A-3977

ALLIS-CHALMERS A-C ALLIS-CHALMERS



Assures trouble-free lubrication for life of new turbine

There is good reason to believe that this new 15,000-KW turbine at Ottertail Power Company's Ortonville, Minnesota, plant will never have to be shut down for oil replacement, oil system cleaning, or because of oil acidity troubles. The basis for this conviction can be found in the company's own experience with NONPAREIL Turbine Oil, lubricant for the new unit.

Since 1931, the Ottertail Power Company has put NONPAREIL into several turbines. In one of those first units, NONPAREIL has now served for 21 years, and the original fill of oil has never needed to be replaced. Although the lubricant has not been removed for treating, it has maintained a neutralization number below 0.09 mg. KOH/gm. The oil system has not required cleaning.

With this evidence of long life is the written guarantee given with each fill of oil that NONPAREIL will last as long as the turbine and will maintain a neutralization number below 0.15 mg. KOH/gm.

You can assure trouble-free lubrication for the life of your turbines by using NONPAREIL Turbine Oil. Phone your Standard Oil Company (Indiana) office for the services of a Standard lubrication specialist. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

NONPAREIL
TRADE MARK
Turbine Oil

STANDARD OIL COMPANY

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(Indiana)